ICOM

SERVICE MANUAL

IC-03AT

220MHz FM TRANSCEIVER

ICOM INCORPORATED

INTRODUCTION

This service manual contains information relative to the theoretical, physical, mechanical and electrical characteristics of the **IC-03AT** 220MHz FM TRANSCEIVER.

ASSISTANCE

If you require assistance or further information regarding the operation and capabilities of the **IC-03AT**, please contact your nearest authorized ICOM Dealer or ICOM Service Center.

ORDERING PARTS

For the fastest service, supply all of the following information when ordering parts from your dealer or ICOM Service Center:

1. Equipment model and serial number
2. Schematic part identifier (e.g., IC301, Q318)
3. Printed circuit board name and number (e.g., MAIN UNIT/B-810I)
4. Part number and name (e.g., 2SC2053 Transistor)
5. Quantity required (e.g., 3pcs.)

REPAIR NOTE

1. **DO NOT** open transceiver covers until the transceiver is disconnected from a power source.
2. **DO NOT** connect the transceiver to an external power source of more than 16V.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts.
5. An insulated tuning tool **MUST BE** used for all adjustments.
6. **DO NOT** keep power ON for a long time when the transceiver is defective.
7. **DO NOT** transmit power into a signal generator or sweep generator. Always connect a 20dB or 30dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
8. Read the instructions of test equipment thoroughly before connecting the equipment to the transceiver.

TABLE OF CONTENTS

The SCHEMATIC DIAGRAM is attached at the end of this manual.

SECTION 1 SPECIFICATIONS

■ GENERAL

• Frequency coverage	:	220.000 ~ 224.995MHz
• Mode	:	F3 (FM)
• Tuning step increments	:	5, 10, 15, 20 or 25kHz (programmable)
• Memory channels	:	10
• Antenna impedance	:	50Ω unbalanced
• Power supply requirement	:	5.5 ~ 16.0V DC (negative ground)
• Current drain (at 8.4V DC)	:	Receive Squelched 50mA Max. audio output 170mA Transmit HIGH (2.0W): 1.8A LOW (0.5W): 700mA
• Usable temperature range	:	−10°C ~ +60°C
• Frequency stability	:	±20ppm (−10°C ~ +60°C)
• Dimensions	:	64(74)W × 160(171)H × 35(41)D mm (Bracketed values include projections)
• Weight	:	515g

■ TRANSMITTER

• Output power	:	HIGH 2.0W (at 8.4V DC) 5.0W (at 13.8V DC) LOW 0.5W
• Modulation system	:	Variable reactance frequency modulation
• Maximum frequency deviation	:	±5.0kHz
• Spurious emissions	:	Less than −60dB below peak output power
• Microphone impedance	:	600Ω

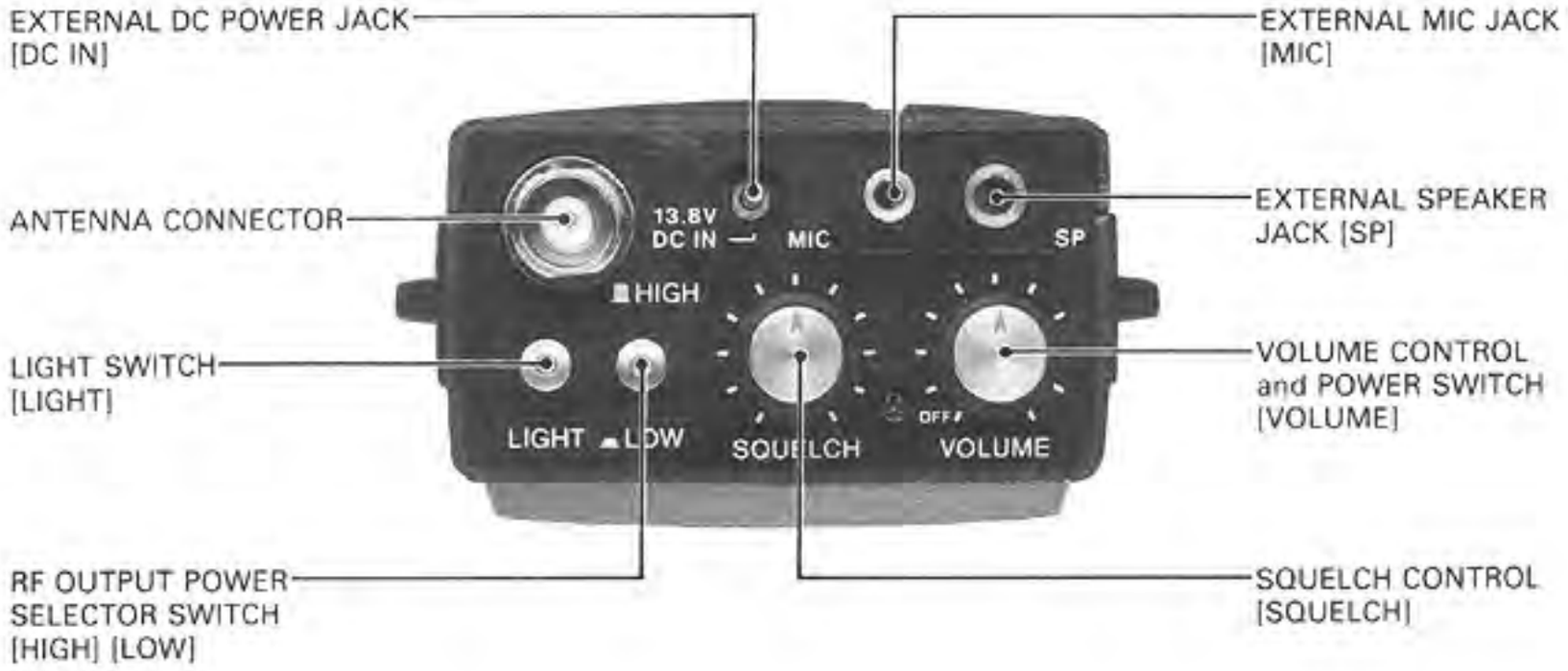
■ RECEIVER

• Receive system	:	Double-conversion superheterodyne
• Intermediate frequencies	:	1st 16.9MHz 2nd 455kHz
• Sensitivity	:	Less than 0.25μV for 12dB SINAD
• Selectivity	:	More than 15kHz/−6dB Less than 30kHz/−60dB
• Squelch threshold sensitivity	:	Less than 0.1μV
• Spurious response rejection ratio	:	More than 60dB
• Audio output power	:	More than 500mW at 10% distortion with an 8Ω load
• Audio output impedance	:	8Ω

All stated specifications are approximate and subject to change without notice or obligation.

SECTION 2 OUTSIDE AND INSIDE VIEWS

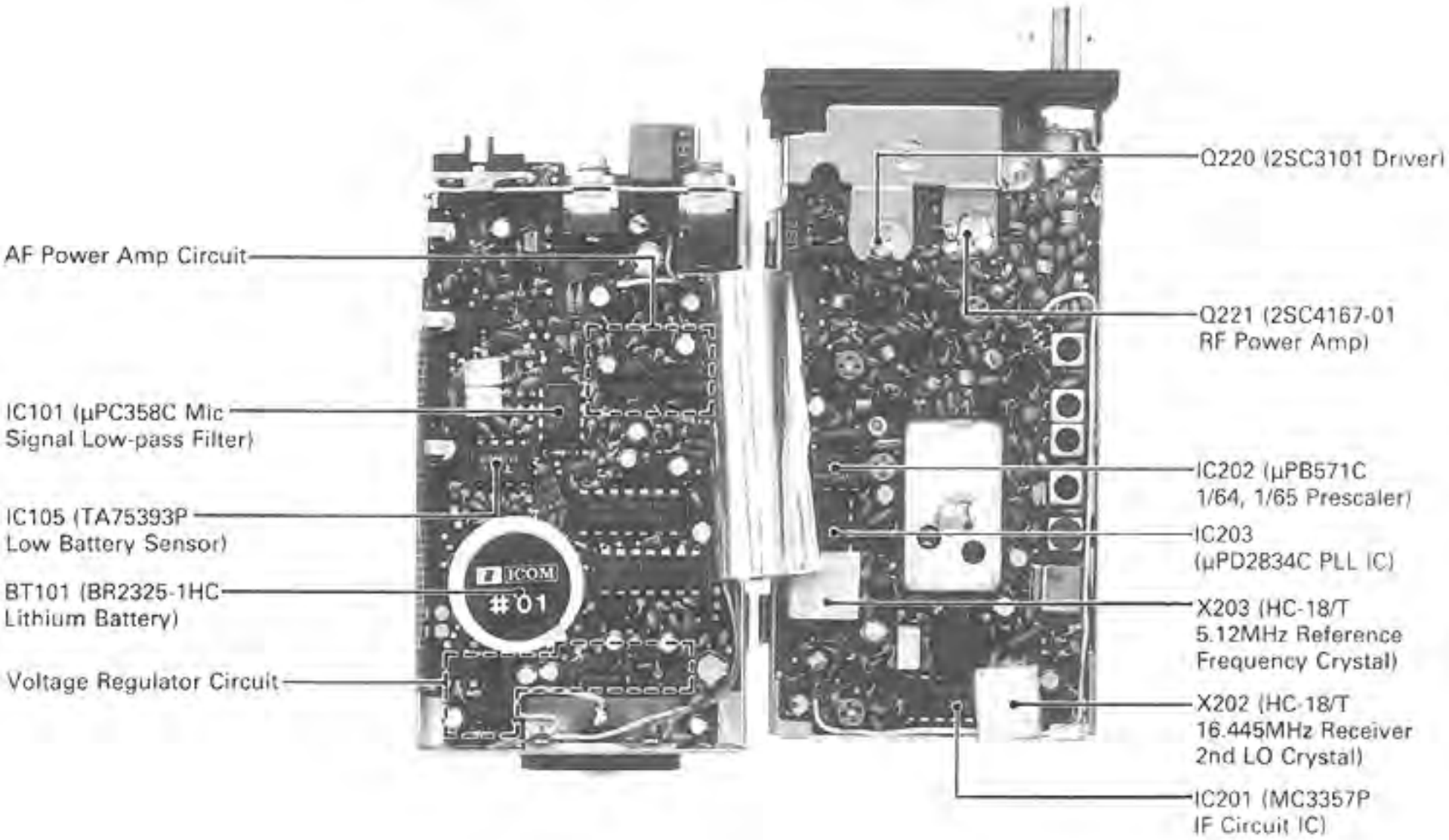
TOP PANEL



FRONT PANEL

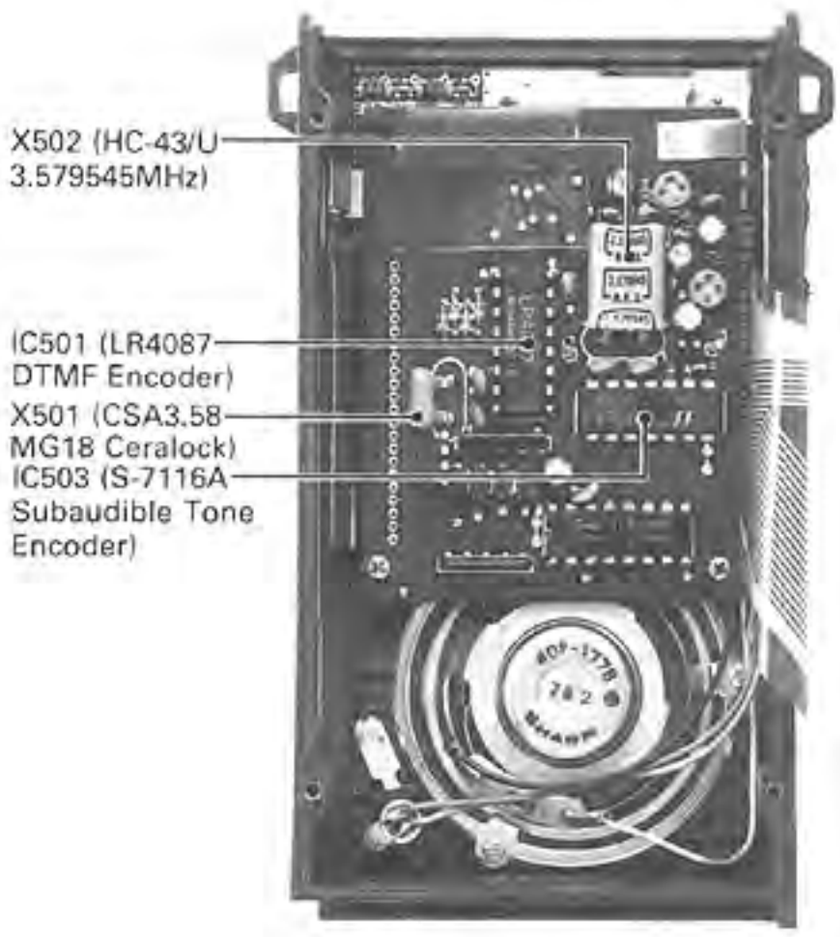
REAR PANEL

MAIN UNIT

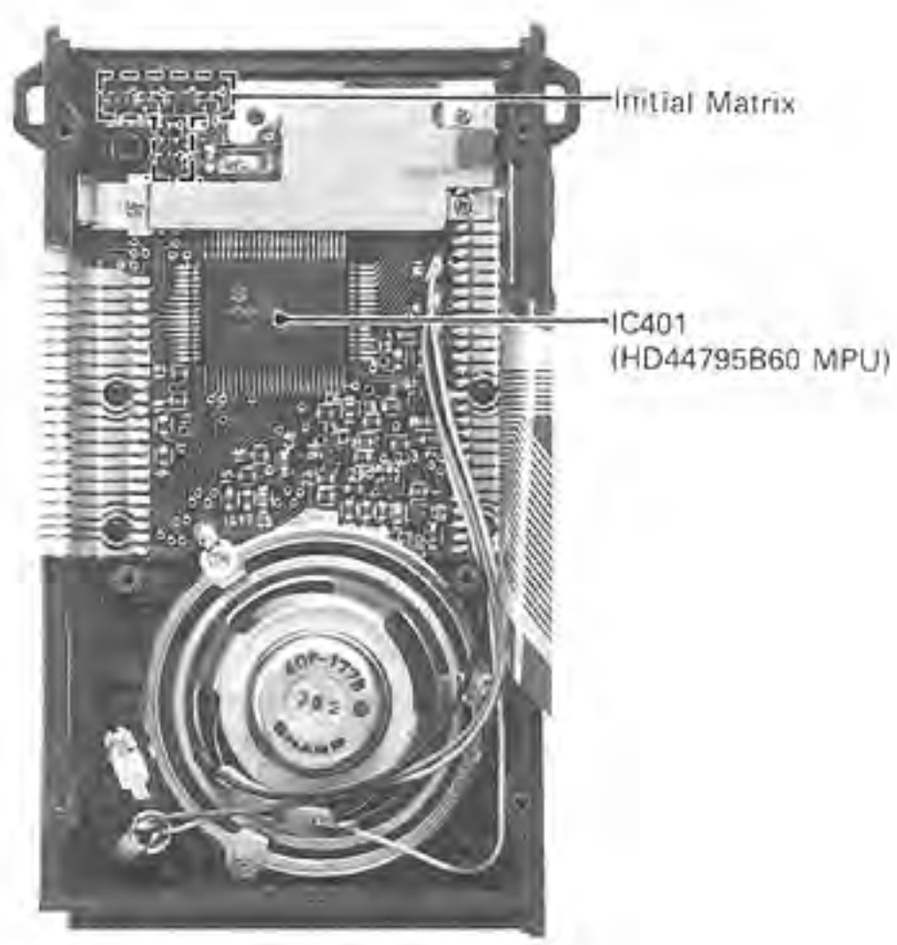


PLL UNIT

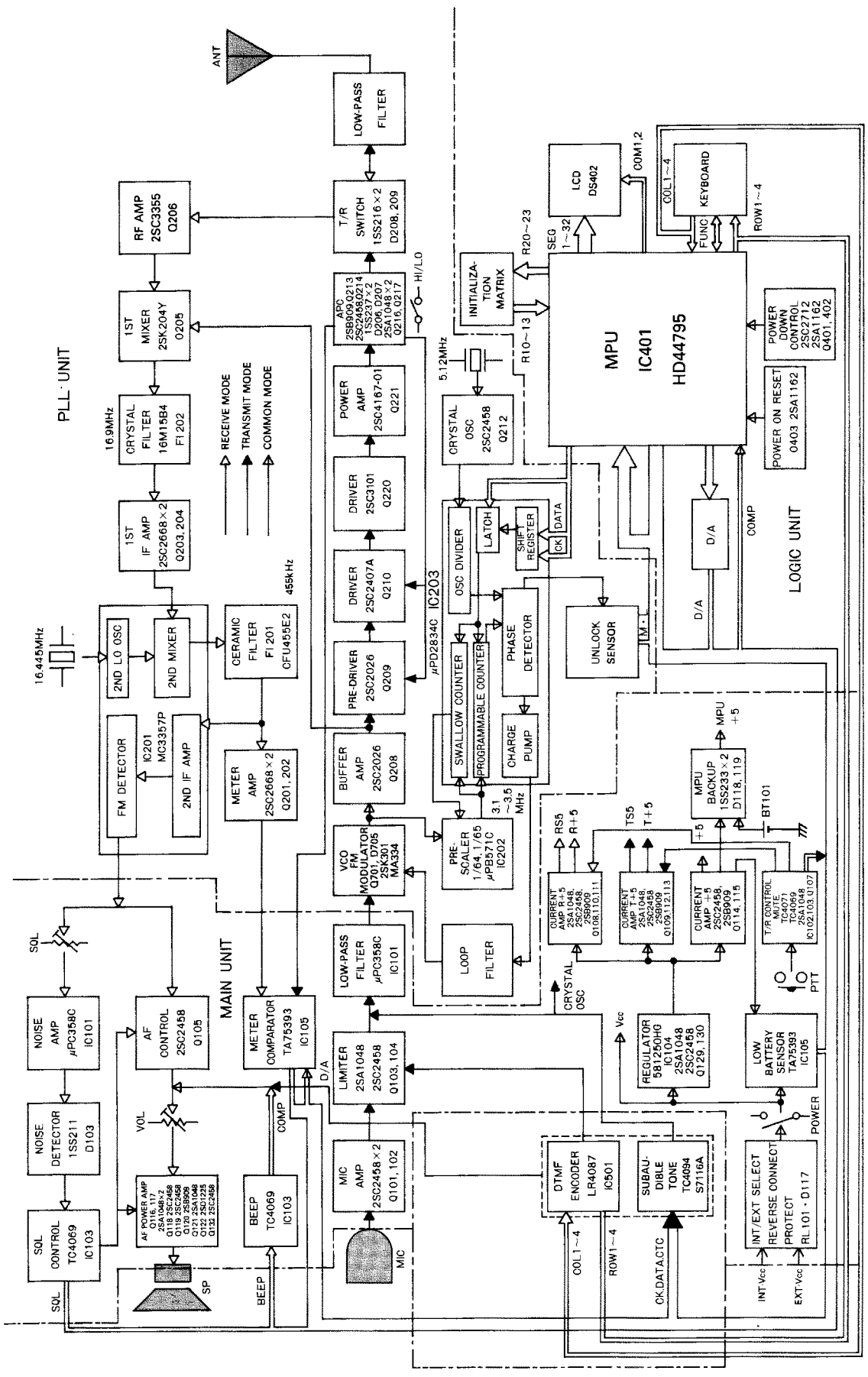
TONE UNIT



LOGIC UNIT



SECTION 3 BLOCK DIAGRAM



SECTION 4 CIRCUIT DESCRIPTION

4 - 1 RECEIVER CIRCUITS

4 - 1 - 1 ANTENNA SWITCHING CIRCUIT (PLL UNIT)

Receive signals enter the PLL UNIT from ANTENNA CONNECTOR J202, pass through a low-pass filter, and are fed to the antenna switching circuit. The low-pass filter is a Chebyschev low-pass filter consisting of L213, L214, C258, C260, C262, C264 and C265. The antenna switching circuit employs a λ/4-type diode switching system which does not allow current to flow during receive operations.

The antenna switching circuit consists of D208 and D209. D208 and D209 are turned OFF during receive operations and the receive signals are fed to the two-stage λ/4 circuit. After passing through the λ/4 circuit, the signals are fed to the RF circuit.

4 - 1 - 2 RF CIRCUIT (PLL UNIT)

After passing through the antenna switching circuit, signals are amplified at Q206. After amplification at Q206, RF out-of-band signals are further suppressed by passing through a bandpass filter consisting of L202 ~ L204. After passing through the bandpass filter, the signals are fed to the gate of 1st mixer Q205.

203MHz band LO signals fed from Q208 pass through transmit/receive switching circuit D203 and are applied to the source of 1st mixer Q205. Receive signals and 203MHz band LO signals are mixed by 1st mixer Q205, and 16.9MHz 1st IF signals are applied to the IF circuit.

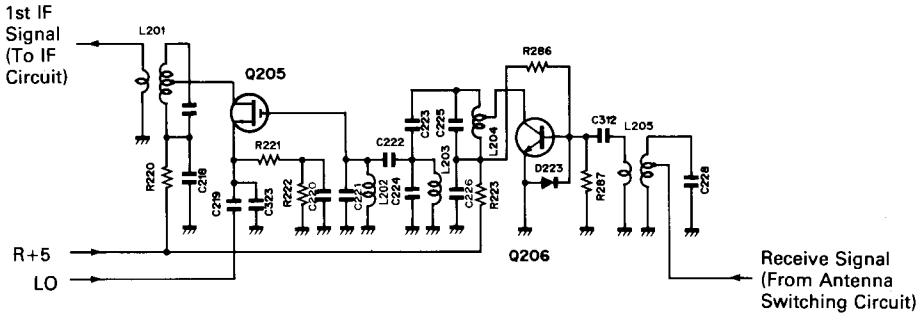


Fig. 4-1 RF Circuit

4 - 1 - 3 IF CIRCUIT (PLL UNIT)

The 1st IF signals converted at Q205 pass through FI202, a pair of crystal mechanical filters with matching characteristics. This further suppresses out-of-band signals. After passing through FI202, the signals are amplified at Q204 and Q203, pass through C213 and are applied to IC201 (pin 16).

IC201 contains the 2nd LO circuit, 2nd mixer circuit, limiter amplifier circuit and quadrature detector circuit. The 2nd LO circuit located in IC201 and X202 generate 16.445MHz 2nd LO signals which are fed to the 2nd mixer section of IC201.

The 1st IF signals and 2nd LO signals applied to IC201 (pin 16) are mixed at the 2nd mixer section in IC201. These are converted to 455kHz 2nd IF signals which are output from IC201 (pin 3).

The 2nd IF signals output from pin 3 are applied to IC201 (pin 5) and to the S-meter amplifier circuit which consists of Q202 and Q201. 2nd IF signals input to pin 5 are amplified by the limiter amplifier section of IC201.

The output of the limiter amplifier section is input to the quadrature detection section and simultaneously output from pin 7.

After being output from pin 7, the signals pass through ceramic resonator X201, are input to IC201 (pin 8) and are detected by the quadrature detector section for conversion to AF signals which are output from pin 9.

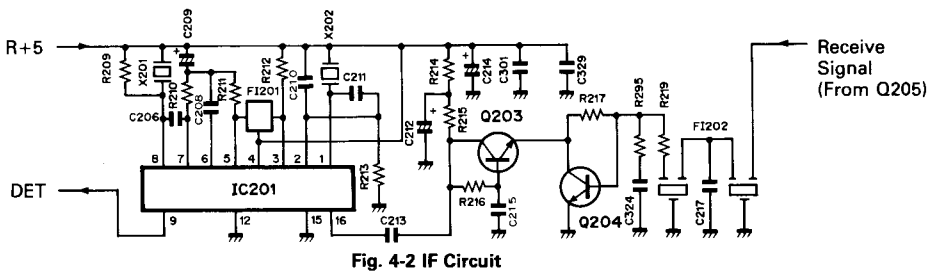


Fig. 4-2 IF Circuit

4 - 1 - 4 S-METER CIRCUIT (PLL UNIT)

Q202 and Q201 are S-meter amplifiers.

A portion of 2nd IF signals from FI201 is amplified at Q202 and Q201. The signals from Q201 pass through C202 and are voltage doubler-detected by D201 and D202.

The output signals from D202 charge C201, and the terminal voltage of C201 is fed to the comparator circuit in the MAIN UNIT.

4 - 1 - 5 AF CIRCUIT (MAIN UNIT)

AF signals output from pin 9 of IC201 pass through a de-emphasis circuit consisting of R127 and C117, and are amplified at AF amplifier Q105. This de-emphasis circuit is an integrator circuit with frequency characteristics of 6dB/oct.

Q116 ~ Q122 are AF power amplifier circuits. The input section functions as a differential amplifier for stable operations, ensuring a suitable frequency response by the negative feedback network, R152 and R149. The AF power amplifier circuit is a complementary SEPP circuit with a Darlington connection of Q119 ~ Q122. This circuit drives SPEAKER SP401.

When the power source voltage is more than 10V, D106 and voltage regulator Q106 limit the output voltage and output power, and stabilize the bias.

4 - 1 - 6 SQUELCH CIRCUIT (MAIN UNIT)

Noise components from pin 9 of IC201 are fed to active filter IC101B through SQUELCH CONTROL R126.

This active filter is a high-pass filter, and amplifies approximately 20kHz noise components. The noise components are then rectified by D103 and converted to DC voltage at R119 ~ R121, C111 and C112. The DC voltage passes through inverters IC103A and IC103B.

AF amplifier Q105 is controlled by voltage from pin 2 of IC103A. The voltage from pin 2 of IC103A is also fed as a SQL signal to MPU IC401 on the LOGIC UNIT through D104.

If no signal is received from the ANTENNA CONNECTOR, the voltage of D103 increases, pin 2 of IC103A becomes "HIGH", Q105 turns OFF and AF output is cut OFF.

In transmit mode, T+5 is applied to pin 9 of IC103B via D105, and pin 2 of IC103A becomes "HIGH", turning Q105 OFF.

4 - 1 - 7 203MHz LO CIRCUIT (VCO, PLL UNITS)

203MHz band LO signals from Q701 in the VCO UNIT are buffer amplified at Q208 and fed to transmit/receive switching circuit D203 in the PLL UNIT. After passing through D203, LO signals are applied to the source of 1st mixer Q205.

4 - 2 TRANSMITTER CIRCUIT

4 - 2 - 1 MICROPHONE AMPLIFIER CIRCUIT (MAIN UNIT)

AF signals from MICROPHONE EP401 or EXTERNAL MIC JACK J203 are amplified at a limiter amplifier consisting of Q101 ~ Q104.

This limiter amplifier has a negative feedback circuit with frequency characteristics set at 6dB/oct. in the 300Hz ~ 3kHz range. This makes the limiter amplifier function as a pre-emphasis circuit. Output from the limiter amplifier is similar to a rectangular waveform and includes harmonic components. Harmonic components higher than 3kHz are attenuated by splatter filter IC101A.

AF signals from IC101A pass through R243 in the PLL UNIT and are then applied to the anode of D705 in the VCO UNIT to perform frequency modulation.

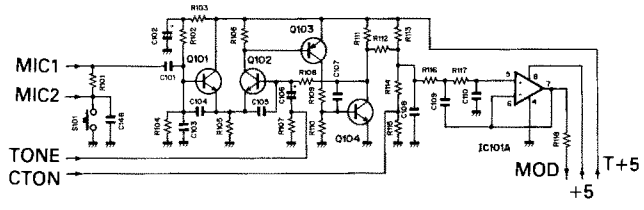


Fig. 4-3 Microphone Amplifier Circuit

4 - 2 - 2 DRIVE AMPLIFIER CIRCUIT (PLL UNIT)

220MHz band signals output from Q701 in the VCO UNIT are buffer amplified by Q208 and pass through transmit/receive switching circuit D204. They are then preamplified at Q209.

Output signals from Q209 are further amplified by drive amplifiers Q210 and Q220.

4 - 2 - 3 RF POWER AMPLIFIER CIRCUIT (PLL UNIT)

Signals output from Q220 are power amplified at Q221. Q221 outputs stable power at approximately 5W when RF POWER SELECTOR SWITCH S105 is in the "HIGH" position.

In transmit mode, a transmit/receive switching circuit consisting of Q215, D208, and D209 is turned ON, and L212 and C256 become a parallel resonance circuit. Output power from Q221 is fed to ANTENNA CONNECTOR J202 through a low-pass filter consisting of L213, L214, C258, C260, C262, C264 and C265.

Q207 controls the bias voltage of Q209, Q210, Q220 and Q221 to prevent unwanted emissions when switching from receive to transmit mode, or when the PLL circuits are unlocked.

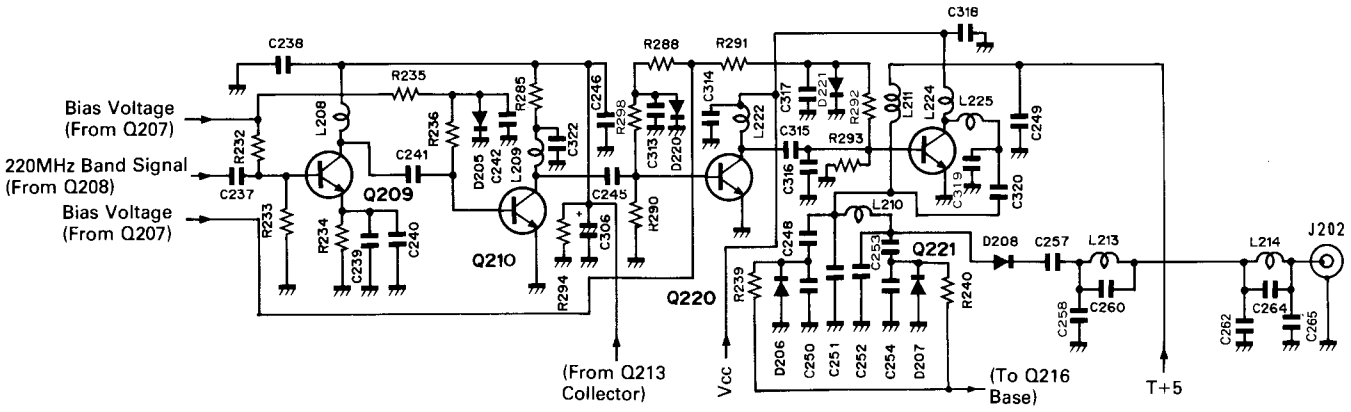


Fig. 4-4 Driver Amplifier and RF Power Amplifier Circuits

4 - 2 - 4 APC AND POWER SET CIRCUITS (PLL UNIT)

L210, C248, C250 ~ C254, D206 and D207 form an antenna mismatching detection circuit. When antenna impedance is matched at 50Ω, voltage detected at D206 and D207 has a minimum value. However, when antenna impedance is in a mismatched condition, the detected voltage becomes higher than in the matched condition.

Q216 and Q217 form the differential amplifier circuit. The base bias voltage of Q217 is determined by R265 ~ R267.

The voltage detected at D206 and D207 is combined by R239 and R240, and fed to the base of Q216.

When antenna impedance is mismatched, the base voltage of Q216 will be higher than the base voltage of Q217. The Q216 collector current and Q214 base current are then reduced, decreasing the Q214 collector current. The Q210 collector current from the base of Q213 also decreases. This decreases the output power of Q210 and Q209 until the base voltage of Q216 becomes the same as the base voltage of Q217.

When RF POWER SELECTOR SWITCH S105 is in the "HIGH" position, RF output power can be adjusted by R267.

When S105 is in the "LOW" position, the series combination of R268 and R269 is connected in parallel with R265, and RF output power can be adjusted by R269.

The output voltage detected at D206 and D207 passes through R241 and is applied to the comparator circuit pin 3 of IC105A on the MAIN UNIT. This voltage is used for the RF power output level meter.

4 - 3 PLL CIRCUITS

The PLL circuits adopt a dual modulus pre-scaler system. The circuits generate desired frequency directly in the VCO circuit.

The PLL circuits are composed of pre-scaler IC202 and PLL IC IC203.

4 - 3 - 1 5kHz REFERENCE FREQUENCY CIRCUIT (PLL UNIT)

IC203 incorporates a swallow counter of 6 binary bits, a programmable counter of 11 binary bits, a phase comparator, a charge pump and a frequency divider for the reference frequency.

A 5.12MHz signal is oscillated by a crystal oscillator consisting of Q212 and X203, and is fed to pin 17 of IC203. IC203 divides the frequency by 1/1024 and a reference frequency of 5kHz is obtained. The 5kHz reference frequency is fed to pin 8 of IC203.

4 - 3 - 2 DUAL MODULUS PRE-SCALER

Signals from the VCO circuit are buffer amplified at Q219 and divided N times at IC202 and IC203.

MPU IC401 feeds IC203 N-data for determining the operating frequency. Signals are then phase detected at IC203 and output from pin 11 of IC203.

IC202 is a pre-scaler that divides signals generated by the VCO from 203MHz to 225MHz by either 1/64 or 1/65.

N-data is the number of times the desired frequency is divided by the reference frequency. (The desired frequency is the transmit frequency in transmit mode and the 1st local oscillator frequency in receive mode).

$$N = \frac{\text{Desired frequency}}{\text{Reference frequency}}$$

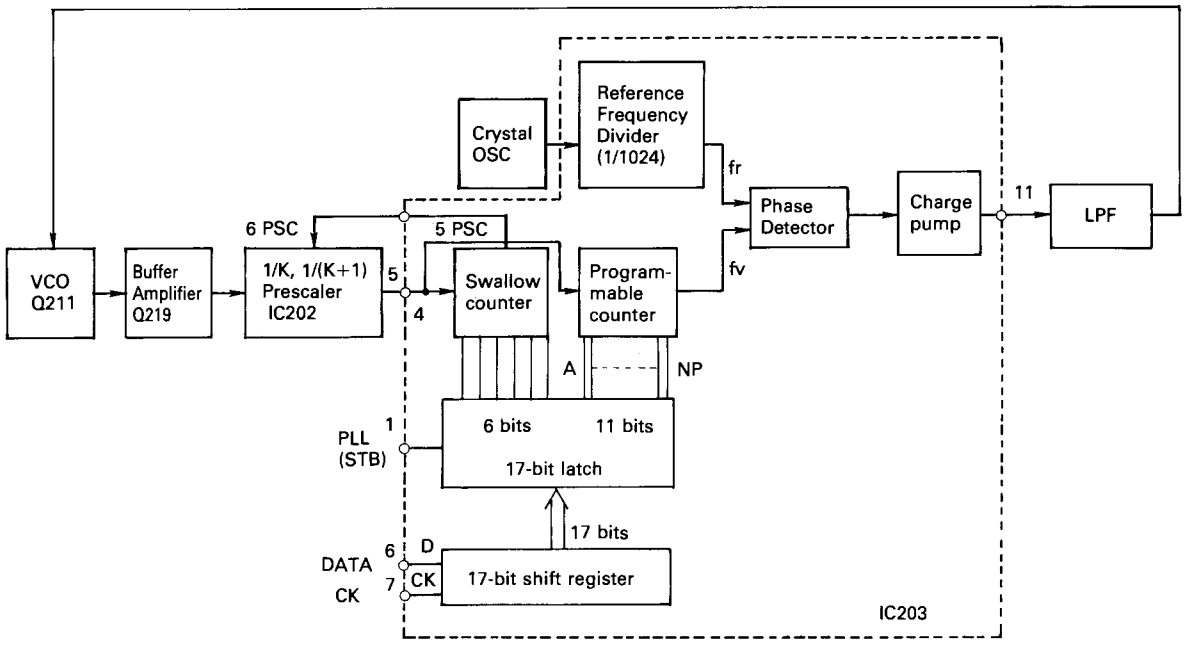


Fig. 4-5 Dual Modulus Prescaler System

4 - 3 - 3 LOOP FILTER, VCO, MODULATION CIRCUITS (PLL, VCO UNITS)

Output from pin 11 of IC203 determines the characteristics of the PLL circuits through a lag-lead type loop filter consisting of R253, R252 and C282. This output controls D703 and D704 in the VCO UNIT through an integrator circuit consisting of R249 and C273.

VCO Q701 employs a Clapp oscillator circuit. By shunting C704 and C705 in receive mode, the VCO free-run frequency is shifted lower from the one in transmit mode. In transmit mode, C704, C705, C715, and D705 are connected in parallel. Thus the free-run frequency will be higher than in receive mode and stable oscillation can be achieved over a wide frequency range.

Output signals pass through the loop filter, and then are applied to D703 and D704 in the VCO UNIT to control the VCO oscillation frequency.

When modulation signals are applied to the anode of D705, the capacitance of D705 is changed and performs frequency modulation. Deviation is adjusted by R243.

4 - 3 - 4 UNLOCK CIRCUIT (PLL UNIT)

When the PLL circuits are unlocked, pin 10 of IC203 is "LOW" and a "LOW" signal is fed as an unlock signal to pin 8 of IC102A through time constant circuit R254 and C283.

As pin 8 and pin 9 of IC102A are "LOW", pin 10 becomes "LOW". The MPU is then fed information that the PLL circuits are unlocked to prevent unwanted signals from being transmitted.

4 - 4 LOGIC CIRCUITS

The main part of the logic circuits is MPU IC401.
This includes a 2k-word ROM, 128-word pattern ROM, 160-byte RAM, and a circuit to drive FREQUENCY DISPLAY DS401.

Following is an explanation of operations and their I/O ports.

I/O Port	Pin no.	Operation
D0 [SEND]	78	This port becomes "LOW" for the SEND line when the transceiver is in transmit mode.
D1 [MUTE]	79	This port becomes "HIGH" for approximately 60msec. when the transceiver is in transmit mode.
D2 [CK]	80	This port outputs serial CK signals for the PLL and subaudible tone encoder circuits.
D3 [DATA]	1	This port outputs serial DATA signals for the PLL and subaudible tone encoder circuits.
D4 [COMP]	2	When this port is "LOW" the number of R3 ports is indicated by the S/RF INDICATOR.
D5 [UNLOCK]	3	This port reads UNLOCK signals from IC102A. When the port reads UNLOCK signals, port D1 becomes "LOW" and a small "U" appears on the FREQUENCY DISPLAY.
D6 [PLL]	4	This port outputs a strobe signal for PLL N-DATA.
D7 [CTCSS]	5	This port outputs strobe signals for the subaudible tone encoder.
D8 [SQL]	6	This port becomes "LOW" when the squelch opens.
D9 [HALT CONT]	7	This is an output port for storing the program execution address of the MPU when the transceiver is turned OFF.
D10 [BEEP]	8	This port becomes "HIGH" when beep sounds are emitted.
D11 [FUNC]	9	This port becomes "LOW" when the FUNCTION SWITCH is pushed.
D12 ~ D15 [KEY SCAN]	10 ~ 13	These are output ports for the KEYBOARD scan.
R0 [KEY RETURN]	14 ~ 17	These are input ports for the keyboard scan. The ports read signals from ports D12 ~ D15 and are connected to the rows of the keyboard matrix.
R1 [INITIAL KEY RETURN]	66 ~ 69	These are input ports for the initial matrix key scan. These ports read signals from the R2 ports to determine frequency ranges, tuning step increments, etc.
R2 [INITIAL KEY SCAN]	70 ~ 73	These are output ports for the initial matrix key scan.
R3 [D/A]	74 ~ 77	These ports output a loop counter number in hexadecimal when the program of the MPU is executed in the main routine.
INT0 [POWER DOWN]	64	This port becomes "LOW" when the transceiver is turned OFF or the power supply voltage goes down.
INT1 [BAT]	65	This port becomes "LOW" when the battery voltage becomes lower than normal.
RESET [RESET]	18	The MPU is reset when this port becomes "HIGH".

Table 4-1 MPU Port Allocations

4 - 5 POWER SUPPLY CIRCUITS

4 - 5 - 1 INTERNAL/EXTERNAL POWER SWITCHING CIRCUIT (MAIN UNIT)

When using a battery pack, relay RL101 is OFF and POWER SWITCH R132 is connected to the battery pack. When a power source with voltage between 10~16V is connected to EXTERNAL DC POWER JACK J204, RL101 is ON and R132 is connected to the external power source.

In case a wrong connection to J204 is made with reverse polarity, D117 is revesely biased, preventing RL101 from being ON and protecting the transceiver.

4 - 5 - 2 VOLTAGE REGULATOR CIRCUITS (MAIN UNIT)

Three-terminal regulator IC104 keeps the output voltage at 5V constantly even with input voltage from 5.1V to 16V.

Noise components are eliminated from the output of IC104 through a filter circuit consisting of R165 and C138. Output from the filter circuit is fed to a current amplifier circuit consisting of Q129 and Q130.

Q129 and Q130 are connected in a complementary circuit for a higher current amplification factor. The base voltage of Q130 is nearly equal to the output voltage of IC104. Also, the collector voltage of Q129 is approximately 5V. As the temperature coefficient of the junction voltage of D114 is nearly equal to the V_{BE} of Q130, the output voltage is kept constant against any change in temperature.

The regulated 5V from the collector of Q129 is fed to common circuits through current amplifier circuit Q114 and Q115, and is also fed to transmit/receive switching circuit Q108 and Q109.

4 - 5 - 3 POWER SOURCE CIRCUIT FOR MPU (MAIN UNIT)

When the battery pack is removed from the transceiver, a voltage is applied to MPU IC401 on the LOGIC UNIT via D119 from BT101 to provide backup for the memory contents.

4 - 5 - 4 VOX POWER SOURCE CIRCUITS (PLL UNIT)

This circuit supplies a voltage to an optional HS-10SA VOX UNIT.

With normal load currents, the voltage drop through R271 is small and approximately 5V is fed to the VOX UNIT. The increase of load currents leads to voltage drops at R271. When the voltage obtained by adding the voltage between the emitter and base of Q218 is equal to the voltage between R272 and cathode voltage of D216, the load current is limited.

4 - 6 OTHER CIRCUITS

4 - 6 - 1 LAMP CIRCUIT (MAIN UNIT)

The lamp circuit consists of Q131, D115, D116, and other components, and drives backlight DS401 at a constant current, ensuring that brightness does not change even with a change of power supply voltage.

When S106 is pushed ON, current flows into R173, resulting in the base voltage of Q131 being approximately Vcc−1.2V as determined by D115 and D116. The emitter voltage of Q131 is then Vcc−0.6V and the voltage at both ends of R172 is kept constant. The result is a constant current even with a change of power supply voltage.

4 - 6 - 2 BEEP CIRCUIT (MAIN UNIT)

This is a phase shift oscillator consisting of IC103F, R155, R156, R158, C131, C132, and C134. The circuit oscillates when the cathode of D113 becomes "HIGH". The oscillating frequency is set at approximately 2500Hz.

4 - 6 - 3 REDUCED VOLTAGE DETECTING CIRCUIT (MAIN UNIT)

The reduced voltage detecting circuit consists of IC105B, and R168 ~ R171.

A regulated 5V is divided at R168 and R169 and a voltage of approximately 1.03V is applied to pin 6 of IC105B. The voltage of Vcc is divided by R170 and R171, and is applied to pin 5. The voltage division ratio is selected so that the voltage at pin 5 is 1.03V when Vcc is approximately 5.6V.

If the Vcc is greater than 5.6V, the voltage at pin 5 of IC105B is higher than that at pin 6. Pin 7 then becomes "HIGH". If the Vcc voltage decreases to less than 5.6V, the voltage at pin 5 is less than that at pin 6. The output voltage at pin 7 and the output of IC105B is then "LOW". This information is fed to MPU IC401, causing the BATTERY CONDITION INDICATOR to appear on the FREQUENCY DISPLAY.

4 - 6 - 4 COMPARATOR CIRCUIT (MAIN UNIT)

The voltage detected in the S-meter circuits and APC circuits is input to pin 3 of IC105A and D/A signals generated in IC401 are fed to pin 2 of IC105A.

The voltage of D/A signals is divided at R166 and R179, and is changed in 16 steps between 0.12V and 1.258V by providing bias at R167.

When the voltage at pin 2 of IC105A is less than that at pin 3, the output at pin 1 is "HIGH". When the voltage at pin 2 is higher and exceeds that of pin 3, pin 1 is "LOW" and the voltage is fed into the MPU.

The MPU counts D/A signals until pin 1 of IC105A is "LOW" and outputs signals for indicating signal strength in receive mode and RF output in transmit mode on the S/RF INDICATOR on FREQUENCY DISPLAY DS402.

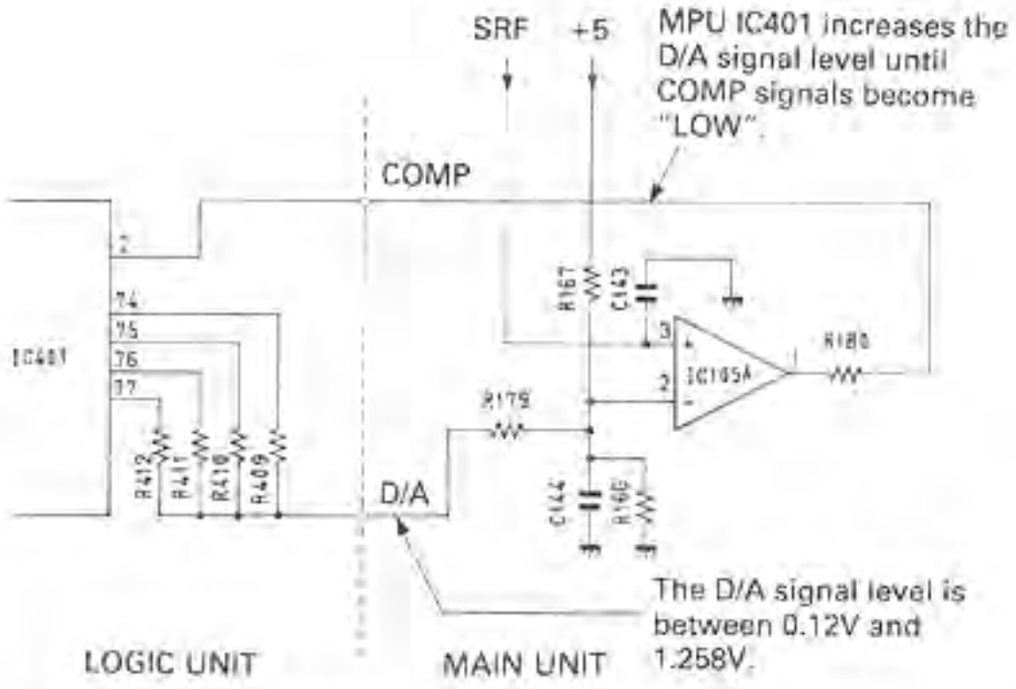


Fig. 4-6 Comparator Circuit

4 - 6 - 5 DTMF ENCODER CIRCUIT (TONE UNIT)

DTMF encoder IC501, generates DTMF telephone dialing tones. While transmitting, Q505 turns ON, applying voltage to IC501.

If there is any input from the KEYBOARD, the proper frequency dividing ratio for the dividing frequency of X501 (3.58MHz) is selected to output one set of audio frequencies corresponding to row input (R_{OW}) and column input (C_{OL}) from pin 16 of IC501.

Also, a "HIGH" level is applied from pin 10 of IC501 when the KEYBOARD is activated. This level has a time constant of approximately 1msec. for turning Q506 ON. Thus key entries can be made without holding PTT S101 down.

4 - 6 - 6 SUBAUDIBLE TONE ENCODER CIRCUIT (TONE UNIT)

When a tone number is set, data is sent to IC502 from MPU IC401 on the LOGIC UNIT. IC502 converts serial data from IC401 to parallel data, and feeds it to IC503. IC503 divides the frequency of X502 (3.579545MHz) corresponding to data, and outputs a subaudible tone from pin 1.

Tone Number	Freq. (Hz)	IC503						Tone Number	Freq. (Hz)	IC503					
		P1	P2	P3	P4	P5	P6			P1	P2	P3	P4	P5	P6
01	67.0	1	0	0	0	0	0	21	136.5	1	0	1	0	1	0
02	71.9	0	1	0	0	0	0	22	141.3	0	1	1	0	1	0
03	74.4	1	1	0	0	0	0	23	146.2	1	1	1	0	1	0
04	77.0	0	0	1	0	0	0	24	151.4	0	0	0	1	1	0
05	79.7	1	0	1	0	0	0	25	156.7	1	0	0	1	1	0
06	82.5	0	1	1	0	0	0	26	162.2	0	1	0	1	1	0
07	85.4	1	1	1	0	0	0	27	167.9	1	1	0	1	1	0
08	88.5	0	0	0	1	0	0	28	173.8	0	0	1	1	1	0
09	91.5	1	0	0	1	0	0	29	179.9	1	0	1	1	1	0
10	94.8	0	1	0	1	0	0	30	186.2	0	1	1	1	1	0
11	97.4	1	1	0	1	0	0	31	192.8	1	1	1	1	1	0
12	100.0	0	0	1	1	0	0	32	203.5	0	0	0	0	0	1
13	103.5	1	0	1	1	0	0	33	210.7	1	0	0	0	0	1
14	107.2	0	1	1	1	0	0	34	218.1	0	1	0	0	0	1
15	110.9	1	1	1	1	0	0	35	225.7	1	1	0	0	0	1
16	114.8	0	0	0	0	1	0	36	233.6	0	0	1	0	0	1
17	118.8	1	0	0	0	1	0	37	241.8	1	0	1	0	0	1
18	123.0	0	1	0	0	1	0	38	250.3	0	1	1	0	0	1
19	127.3	1	1	0	0	1	0								
20	131.8	0	0	1	0	1	0								

1: ON 0: OFF

Table 4-2 Subaudible Tone Encoder Frequency Settings

4 - 6 - 7 TRANSMIT/RECEIVE SWITCHING CIRCUIT (MAIN UNIT)

When PTT S101 is pushed, Q107 turns ON and pin 13 of IC103C and pin 1 of IC102 become "HIGH". Pin 2 of IC102C remains "LOW" for approximately 20msec. via time constant circuit R138 and C122. After 20msec. IC102C becomes "HIGH", thus Q108 is turned OFF and Q109 is turned ON and the T+5 and TS5 lines become 5V. Also, "transmit information" is sent to the MPU from pin 12 of IC103C via D107.

MUTE signals from MPU IC401 remain "HIGH" for approximately 60msec. after S101 is pushed. The signals are applied to pin 13 of IC102D to prevent unstable RF output power transmissions.

When S101 is released, pin 3 of IC102C becomes "LOW" after 20msec. and turns Q108 ON and Q109 OFF.

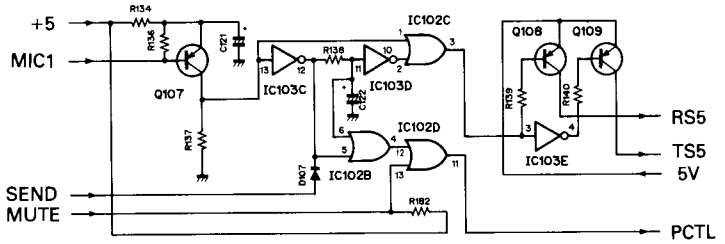


Fig. 4-7 Transmit/Receive Switching Circuit

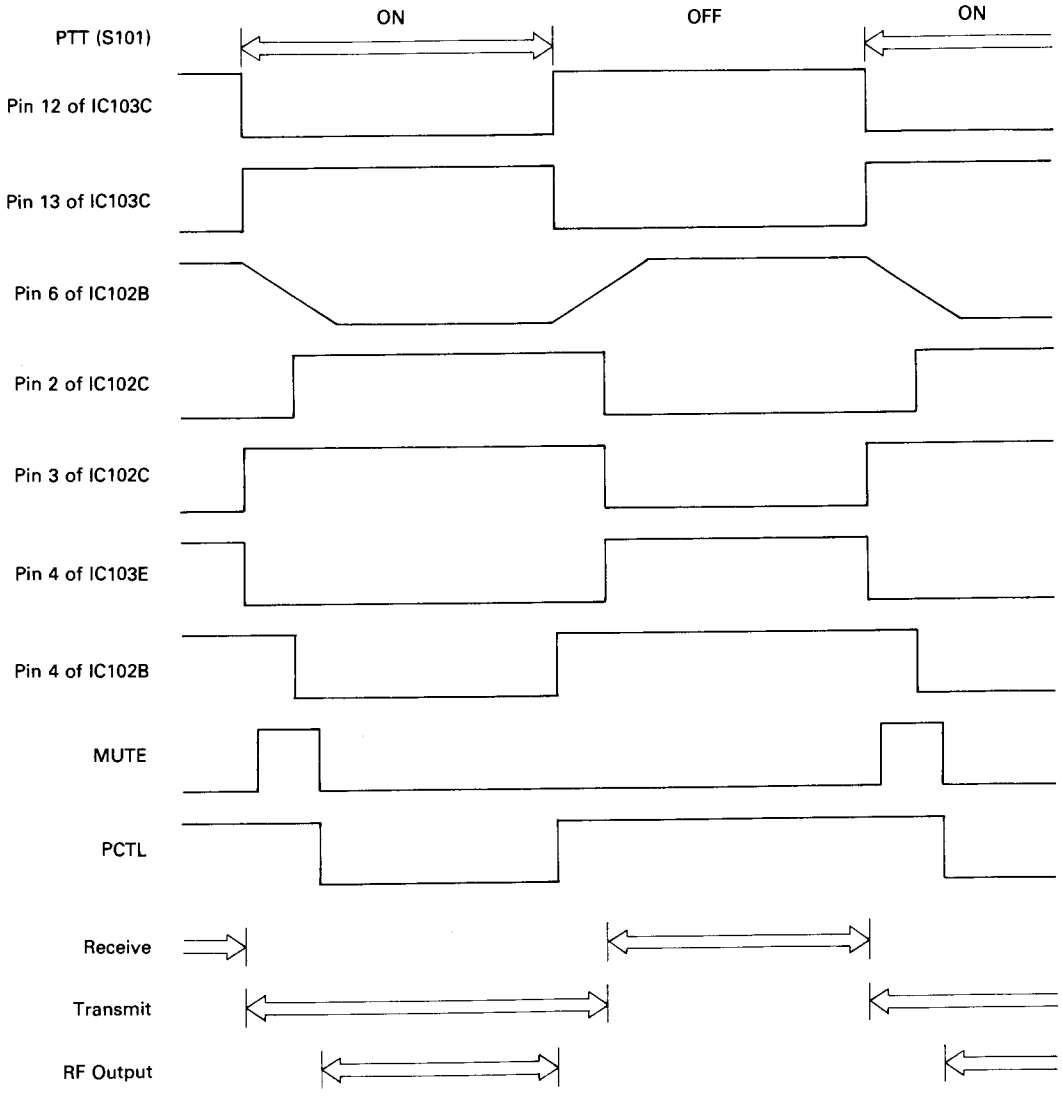


Fig. 4-8 Timing Diagram of Transmit/Receive Switching

SECTION 5 MECHANICAL PARTS AND DISASSEMBLY

5 - 1 CASE DISASSEMBLY

1. Turn power OFF and remove the battery pack.
2. Remove screw Ⓐ, four screws Ⓑ on the REAR PANEL and four screws Ⓒ on the bottom as shown in Fig. 5-1-1.

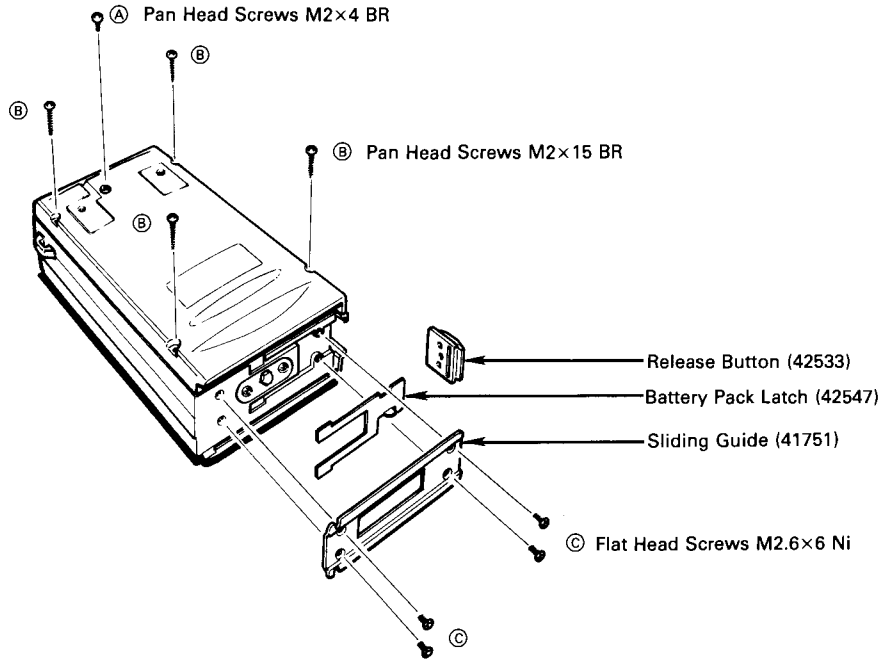


Fig. 5-1-1

3. Remove the REAR PANEL as shown in Fig. 5-1-2.

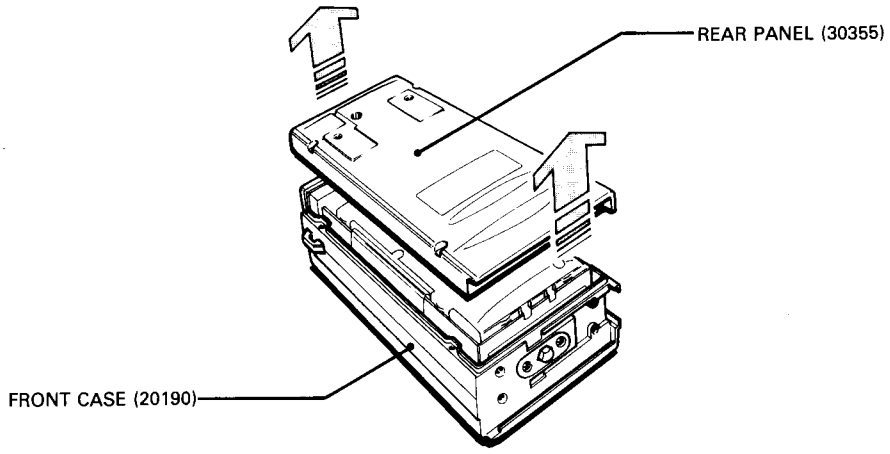


Fig. 5-1-2

4. Slide the inner frame upward slightly as shown in Fig. 5-1-3, and lift the frame away from the FRONT CASE. Be sure not to damage the flexible cable while removing the FRONT CASE.

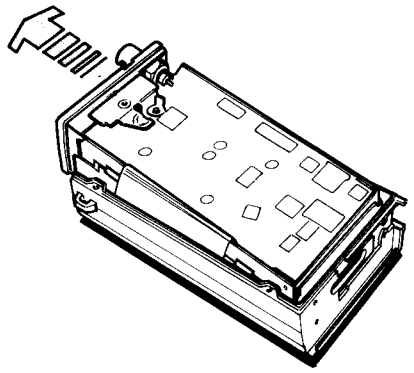


Fig. 5-1-3

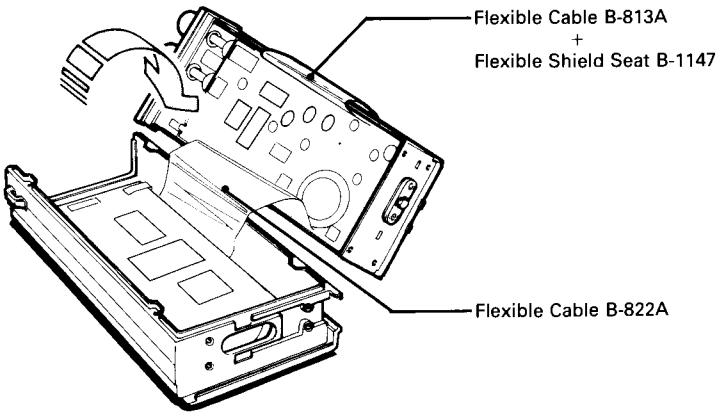


Fig. 5-1-4

5. To see the foil sides of the MAIN and PLL UNITS, remove the SQUELCH CONTROL and VOLUME CONTROL and POWER SWITCH knobs as shown in Fig. 5-1-5. Remove the four screws Ⓐ on the sides of the inner frame as shown in Fig. 5-1-6.

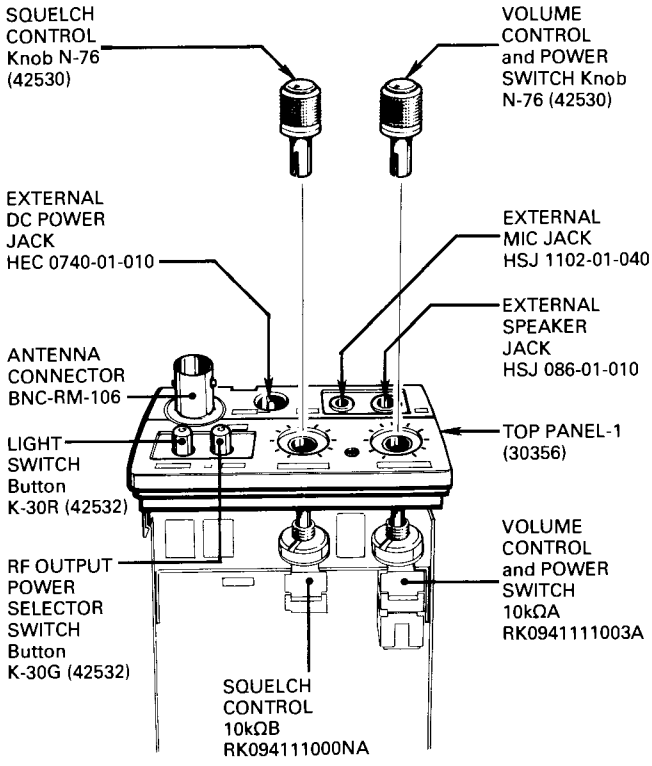


Fig. 5-1-5

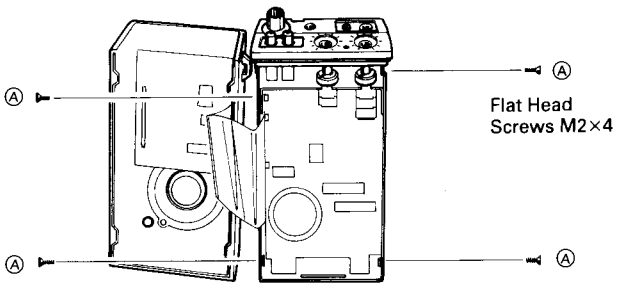


Fig. 5-1-6

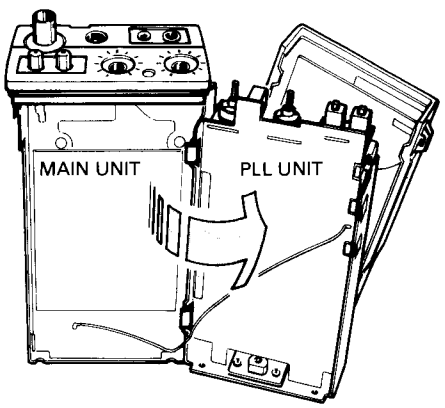


Fig. 5-1-7

5 - 2 TOP PANEL DISASSEMBLY

1. Remove screw Ⓐ as shown in Fig. 5-2-1.
2. Remove the BNC Nut and the BNC Washer as shown in Fig. 5-2-2.
3. Remove the ANTENNA CONNECTOR by unsoldering point Ⓑ on the components side and point Ⓒ on the foil side of the PLL UNIT.
4. Remove the TOP PANEL-1 by slightly prying it outward on both sides at points Ⓓ as shown in Fig. 5-2-3. DO NOT break the tabs.

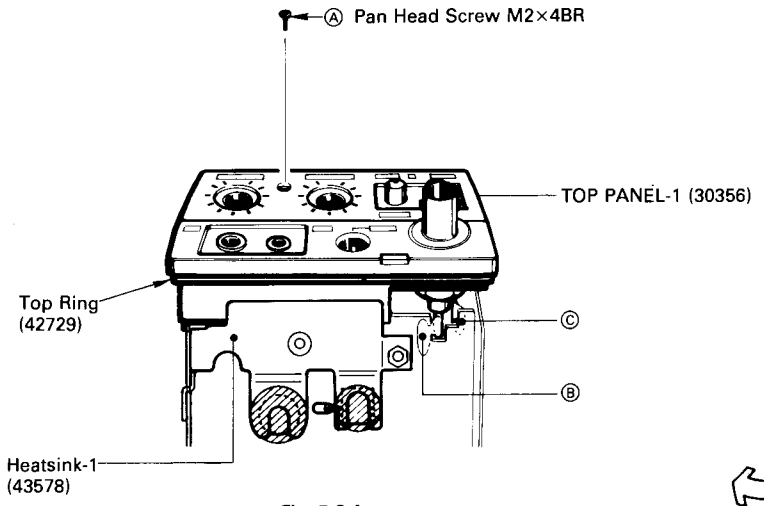


Fig. 5-2-1

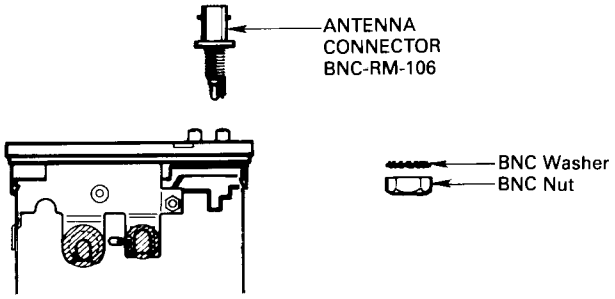


Fig. 5-2-2

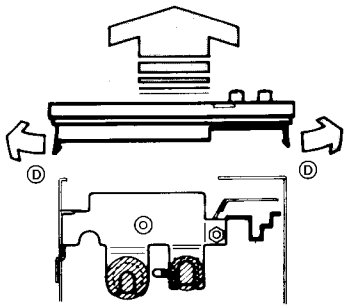


Fig. 5-2-3

5 - 3 HEATSINK DISASSEMBLY

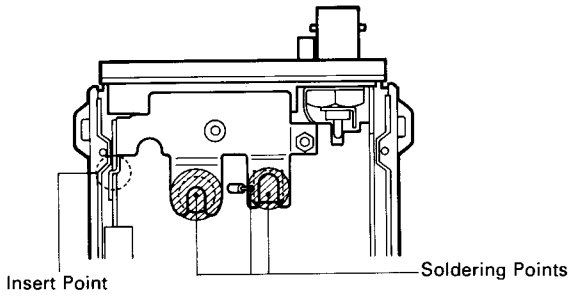


Fig. 5-3-1

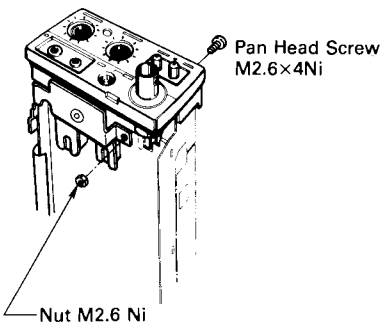


Fig. 5-3-2

5 - 4 SPEAKER/MICROPHONE DISASSEMBLY

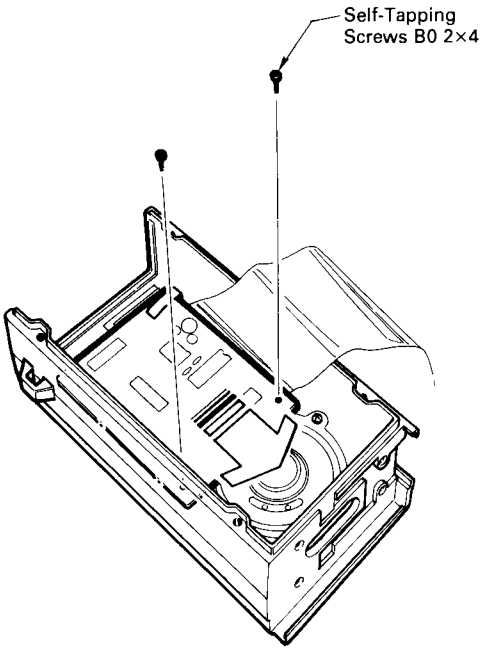


Fig. 5-4-1

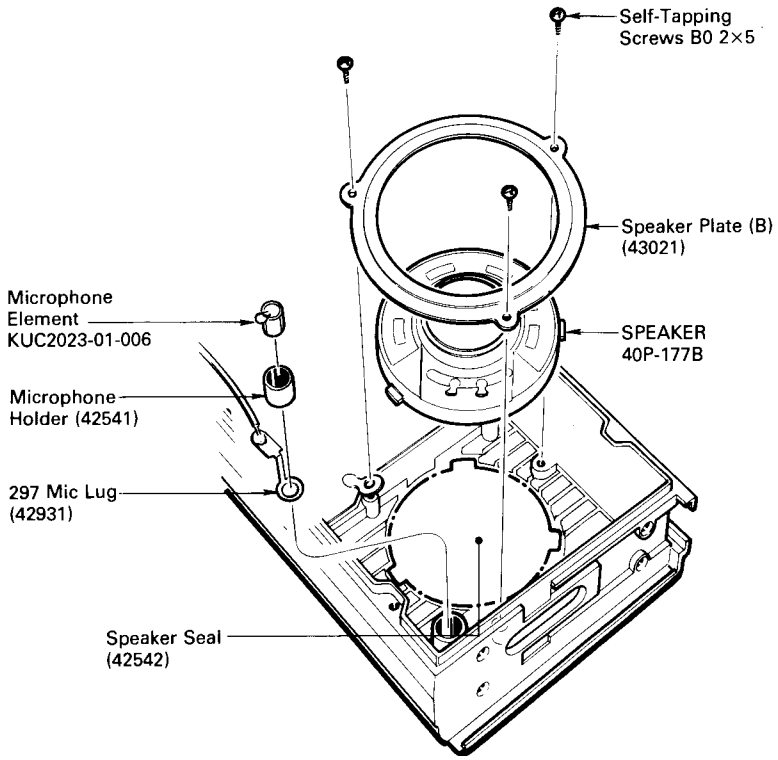


Fig. 5-4-2

5 - 5 PTT SPRING DISASSEMBLY

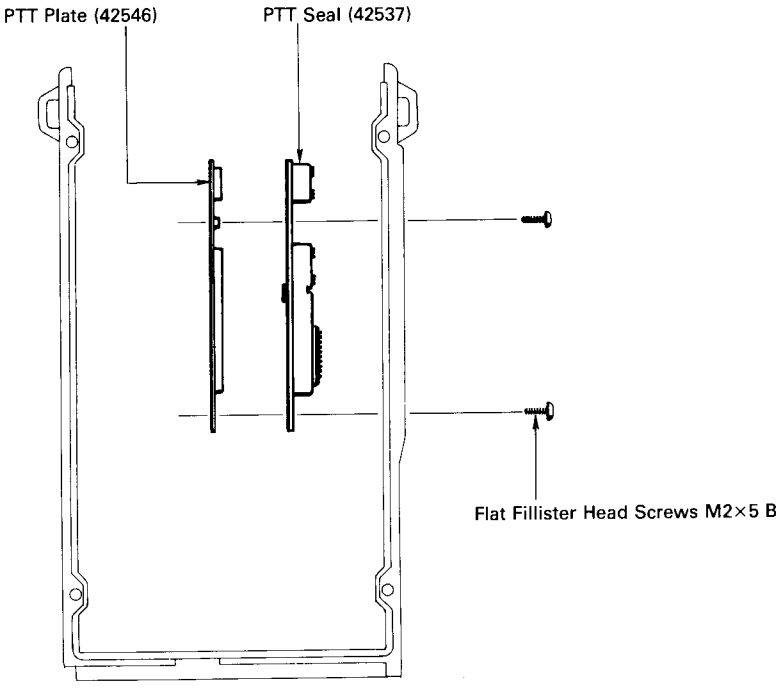


Fig. 5-5-1

5 - 6 UNIT BOTTOM DISASSEMBLY

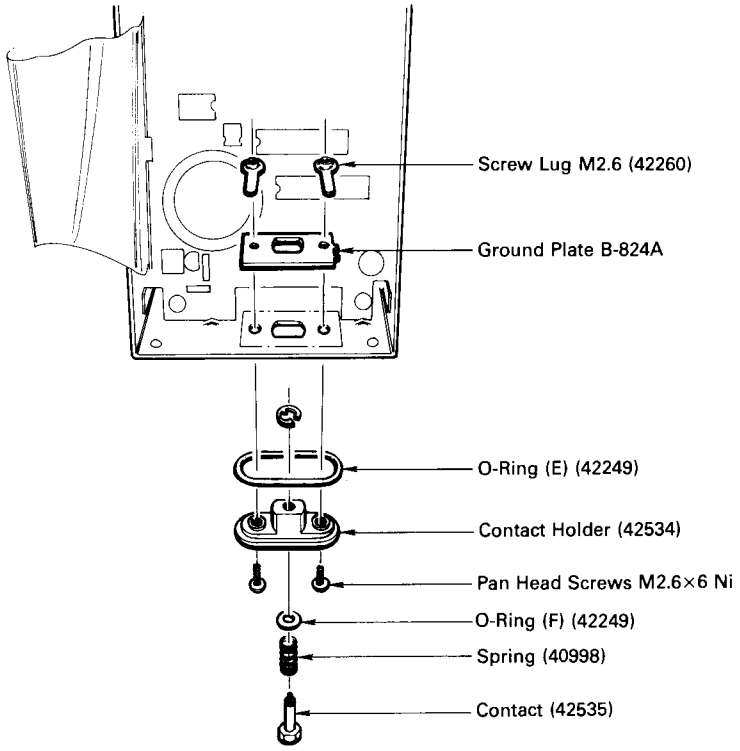


Fig. 5-6-1

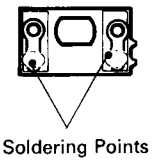


Fig. 5-6-2

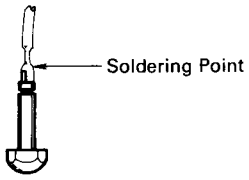
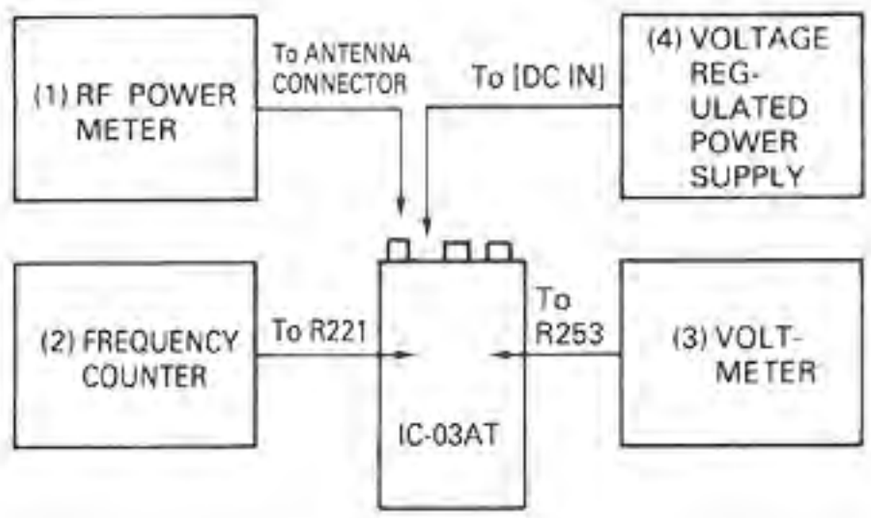


Fig. 5-6-3

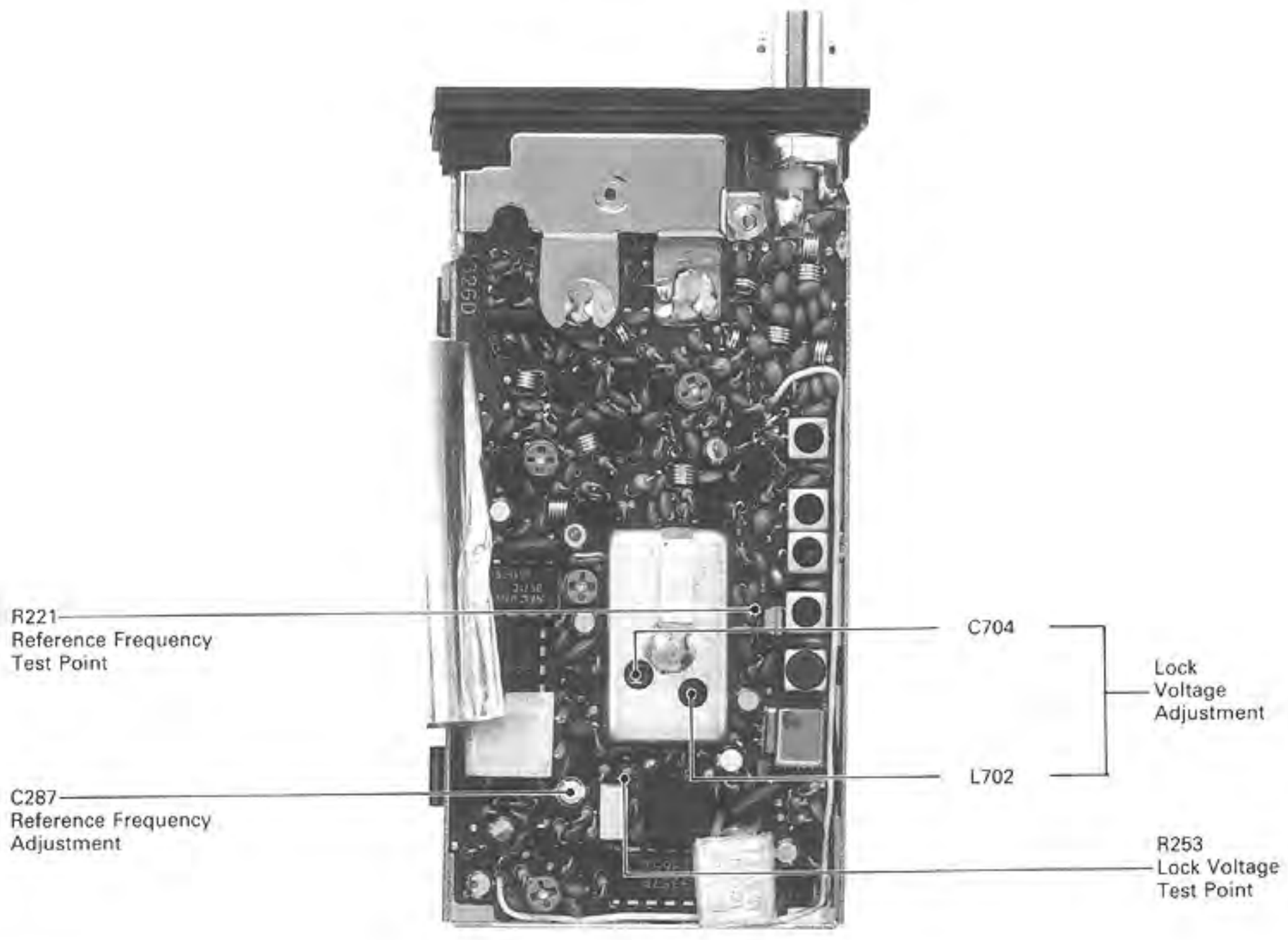
SECTION 6 ADJUSTMENT PROCEDURES

6 - 1 PLL ADJUSTMENT

TEST INSTRUMENTS REQUIRED	MEASUREMENT CONNECTION LOCATION
(1) RF POWER METER (TERMINATED TYPE) • Measuring range : 0 ~ 10W • Frequency range : At least 250MHz • Impedance : 50Ω • SWR : Less than 1:1.2 (2) FREQUENCY COUNTER • Frequency range : At least 250MHz • Accuracy : Better than ±1ppm • Sensitivity : 100mV or better (3) VOLTMETER • Input impedance : 50kΩ DC or better (4) VOLTAGE REGULATED POWER SUPPLY • Output voltage : 13.2V DC • Current capacity : 2A	

ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
LOCK VOLTAGE	1	• Operating frequency: 220.000MHz • Receive mode	PLL	Connect a voltmeter to R253.	1.0V	VCO	L702
	2	• Transmit mode • Simplex mode			1.0V		C704
	3	• Operating frequency: 224.995MHz • Receive mode			More than 2.0V		Verify
REFERENCE FREQUENCY	1	• Operating frequency: 224.000MHz • Simplex mode • Receive mode	PLL	Connect a frequency counter to R221.	207.100MHz	PLL	C287
	2	• RF OUTPUT POWER SELECTOR SWITCH: LOW • Transmit mode			224.000MHz ±300Hz		Verify

PLL UNIT


R221
Reference Frequency
Test Point
C287
Reference Frequency
Adjustment
C704
L702
Lock
Voltage
Adjustment
R253
Lock Voltage
Test Point

6 - 2 RECEIVER ADJUSTMENT

TEST INSTRUMENTS REQUIRED	MEASUREMENT CONNECTION LOCATION

(1) SIGNAL GENERATOR
- Frequency range : 200 ~ 250MHz
- Output level : 0.1μV ~ 3.2mV

(2) DISTORTION METER
- Frequency range : 1kHz ±10Hz
- Measuring range : 1% ~ 100%

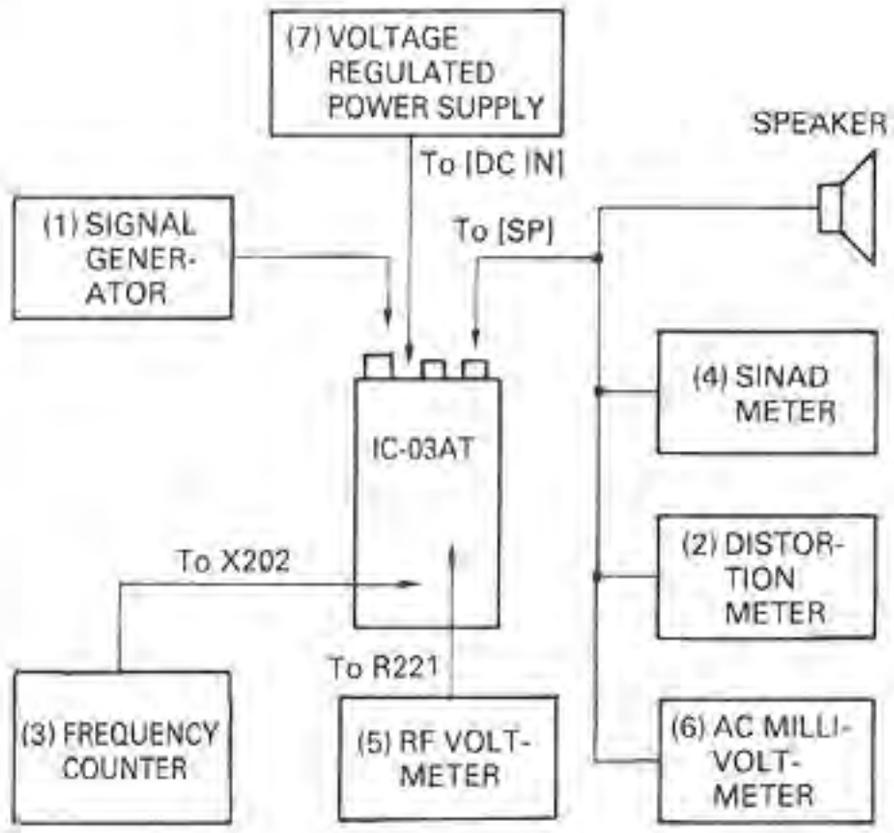
(3) FREQUENCY COUNTER
- Frequency range : At least 250MHz
- Accuracy : Better than ±1ppm
- Sensitivity : 100mV or better

(4) SINAD METER

(5) RF VOLTMETER
- Frequency range : At least 50MHz
- Measuring range : 0.01 ~ 10V

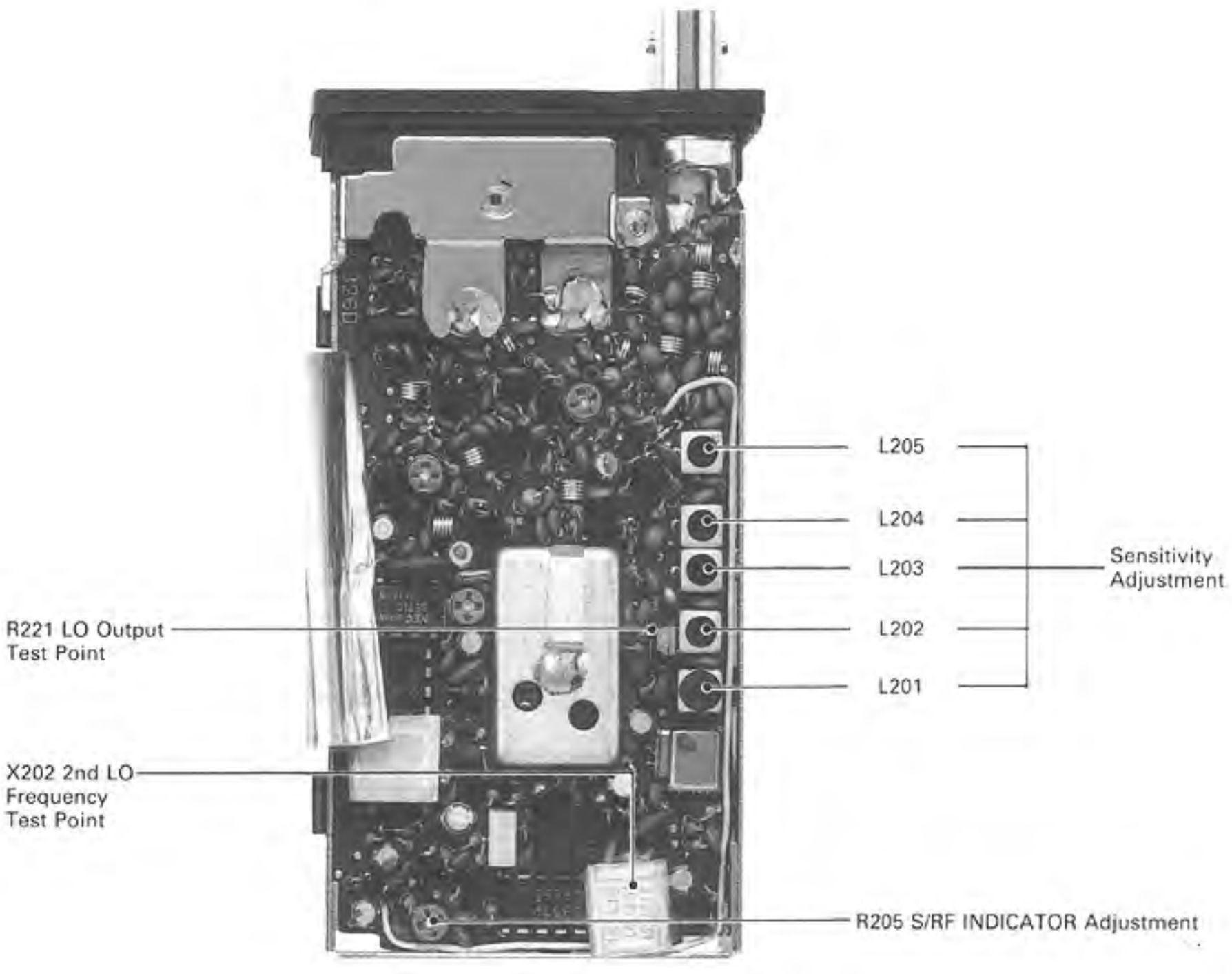
(6) AC MILLI-VOLTMETER
- Measuring range : 10mV ~ 10V

(7) VOLTAGE REGULATED POWER SUPPLY
- Output voltage : 13.2V DC
- Current capacity : 2A

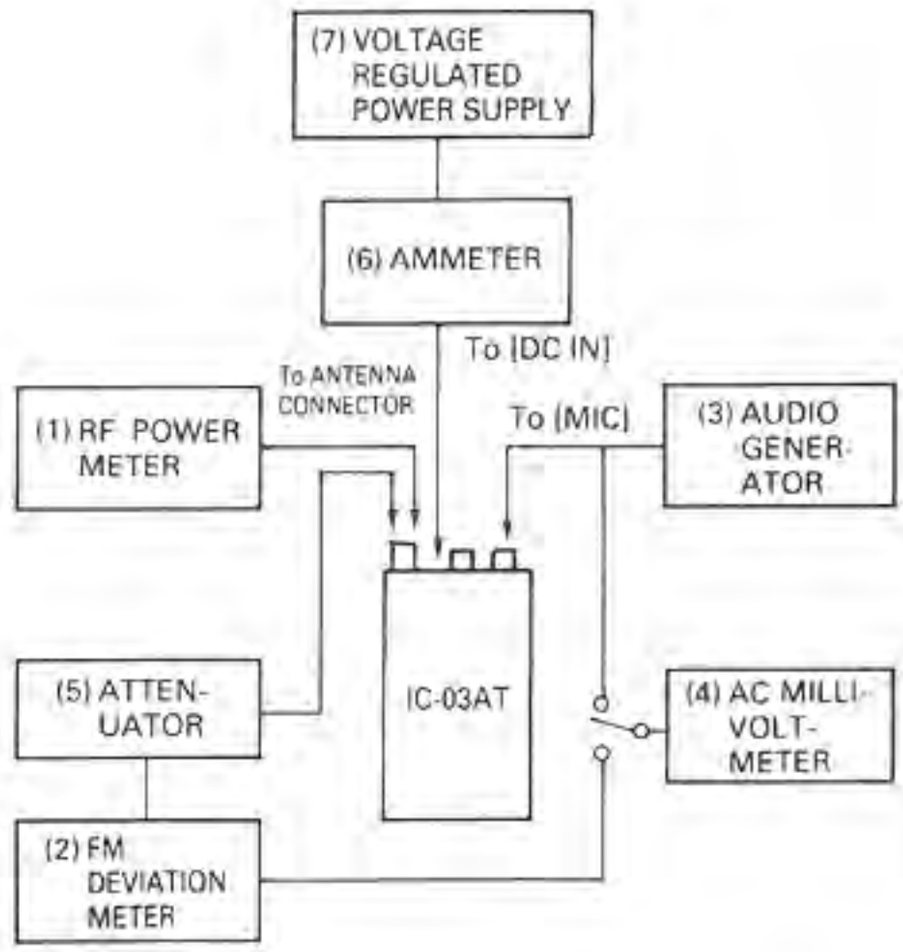


ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
LO OUTPUT	1	• Operating frequency: 224.995MHz • Receive mode	PLL	Connect an RF voltmeter to R221.	Approx. 100mV		Verify
2nd LO FREQUENCY	1	• Operating frequency: Any • Receive mode	PLL	Loosely couple a frequency counter to X202.	16.445MHz ±500Hz		Verify
SENSITIVITY	1	• Operating frequency: 224.990MHz • Receive mode • SQUELCH CONTROL: Max. counterclockwise • Apply an RF signal to the ANTENNA CONNECTOR. Level: 0.4μV Dev. : ±3.5kHz Mod.: 1kHz	TOP PANEL	Connect a SINAD meter to the EXTERNAL SPEAKER JACK with an 8Ω speaker.	Maximum level	PLL	L201 ~ L203
	2	• Operating frequency: 220.100MHz			Maximum level		L204, L205
		Note: Repeat steps 1 and 2 several times, until the measured value is at maximum.					
AF OUTPUT	1	• Operating frequency: 223.100MHz • Receive mode • Apply an RF signal to the ANTENNA CONNECTOR. Level: 10μV Dev. : ±3.5kHz Mod.: 1kHz	TOP PANEL	Connect an AC milli-volt-meter and distortion meter to the EXTERNAL SPEAKER JACK with an 8Ω speaker.	More than 2.0Vrms at 10% distortion.		Verify
S/RF INDICATOR	1	• Operating frequency: 223.100MHz • Receive mode • Apply an RF signal to the ANTENNA CONNECTOR Level: 2.5μV	FRONT PANEL	S/RF INDICATOR.	8 dots	PLL	R205
TIGHT SQUELCH SENSITIVITY	1	• Operating frequency: 223.100MHz • Receive mode • SQUELCH CONTROL: Max. clockwise • Apply an RF signal to the ANTENNA CONNECTOR. Level: 0.4μV Dev. : ±3.5kHz Mod.: 1kHz	TOP PANEL	Connect an 8Ω speaker to the EXTERNAL SPEAKER JACK.	Squelch opens.		Verify

PLL UNIT

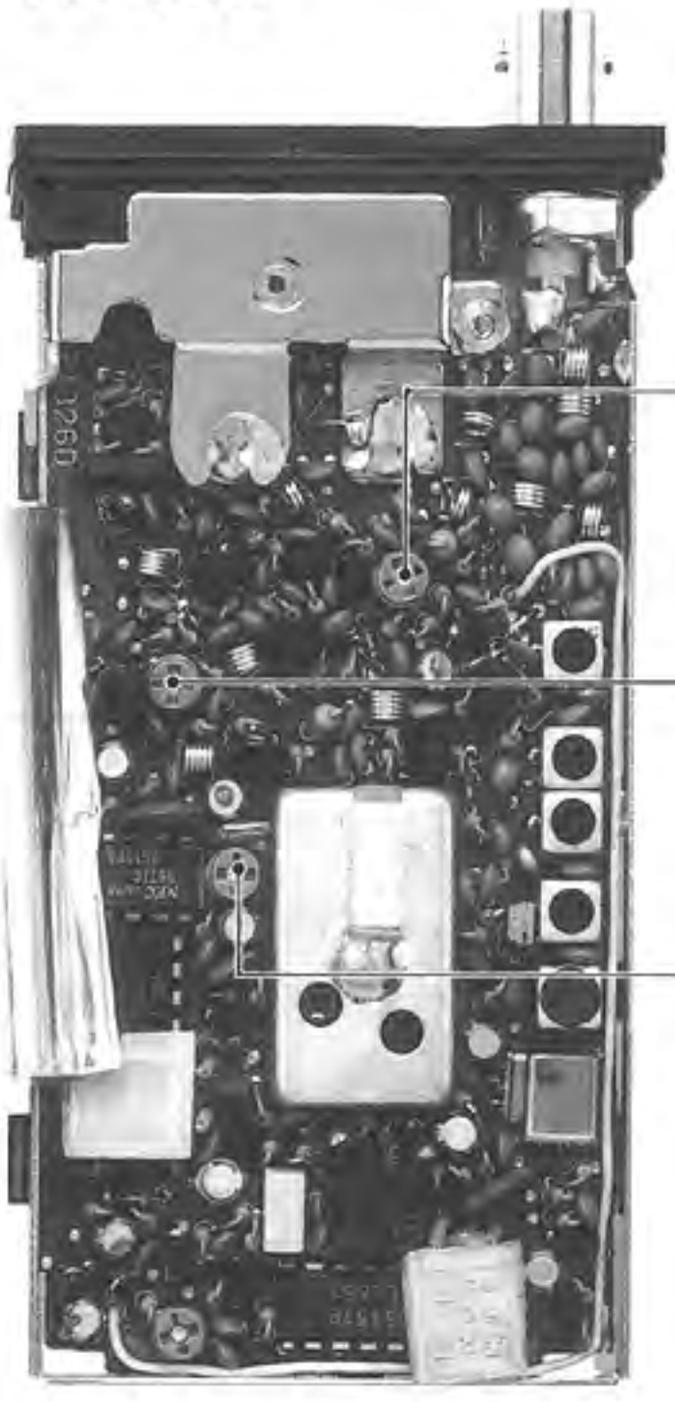

L205
L204
L203
L202
L201
Sensitivity Adjustment
R221 LO Output Test Point
X202 2nd LO Frequency Test Point
R205 S/RF INDICATOR Adjustment

6 - 3 TRANSMITTER ADJUSTMENT

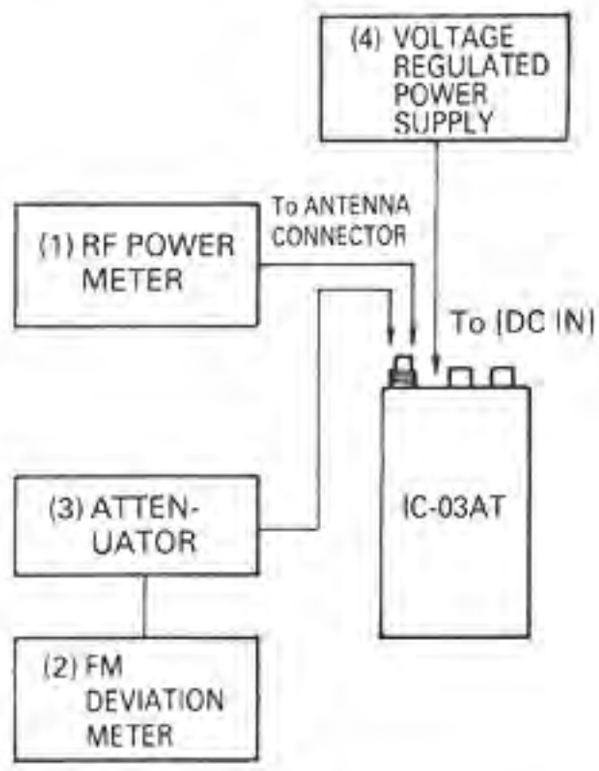
TEST INSTRUMENTS REQUIRED	MEASUREMENT CONNECTION LOCATION
(1) RF POWER METER (TERMINATED TYPE) • Measuring range : 0 ~ 10W • Frequency range : At least 250MHz • Impedance : 50Ω • SWR : Less than 1:1.2 (2) FM DEVIATION METER • Frequency range : At least 250MHz • Measuring range : 0 ~ ±10kHz (3) AUDIO GENERATOR • Output frequency : 50 ~ 3000Hz • Output level : 0 ~ 200mV • Distortion : Less than 0.1% (4) AC MILLI-VOLTMETER • Measuring range : 10mV ~ 2V (5) ATTENUATOR • Input power : At least 5W • Attenuation : 20dB or 30dB (6) AMMETER • Measuring range : 0 ~ 2A (7) VOLTAGE REGULATED POWER SUPPLY • Output voltage : 8.4/13.2V DC selectable • Current capacity : 2A	

ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
OUTPUT POWER	1	• Operating frequency: 223.000MHz • RF OUTPUT POWER SELECTOR SWITCH: HIGH • Power supply: 13.2 V • Simplex mode • Transmit mode	TOP PANEL	Connect an RF power meter to the ANTENNA CONNECTOR.	5.0W	PLL	R267
	2			Ammeter	Less than 1.8A		Verify
	3	• RF OUTPUT POWER SELECTOR SWITCH: LOW • Transmit mode		Connect an RF power meter to the ANTENNA CONNECTOR.	0.5W		R269
	4			Ammeter	Less than 700mA		Verify
	5	• RF OUTPUT POWER SELECTOR SWITCH: HIGH • Power supply: 8.4V • Transmit mode		Connect an RF power meter to the ANTENNA CONNECTOR.	More than 2.0W		Verify
S/RF INDICATOR	1	• Operating frequency: 223.000MHz • RF OUTPUT POWER SELECTOR SWITCH: HIGH • Transmit mode	FRONT PANEL	S/RF INDICATOR	Full scale		Verify
	2	• RF OUTPUT POWER SELECTOR SWITCH: LOW • Transmit mode			10 ~ 18 dots		Verify
DEVIATION	1	• Operating frequency: 222.550MHz • RF OUTPUT POWER SELECTOR SWITCH: HIGH • Apply an AF signal to the EXTERNAL MIC JACK Level: 1kHz/170mV • Transmit mode	TOP PANEL	Connect an FM deviation meter to the ANTENNA CONNECTOR via an attenuator.	±5kHz	PLL	R243
	2	• Verify both band edges			±5kHz ± 10%		Verify

PLL UNIT

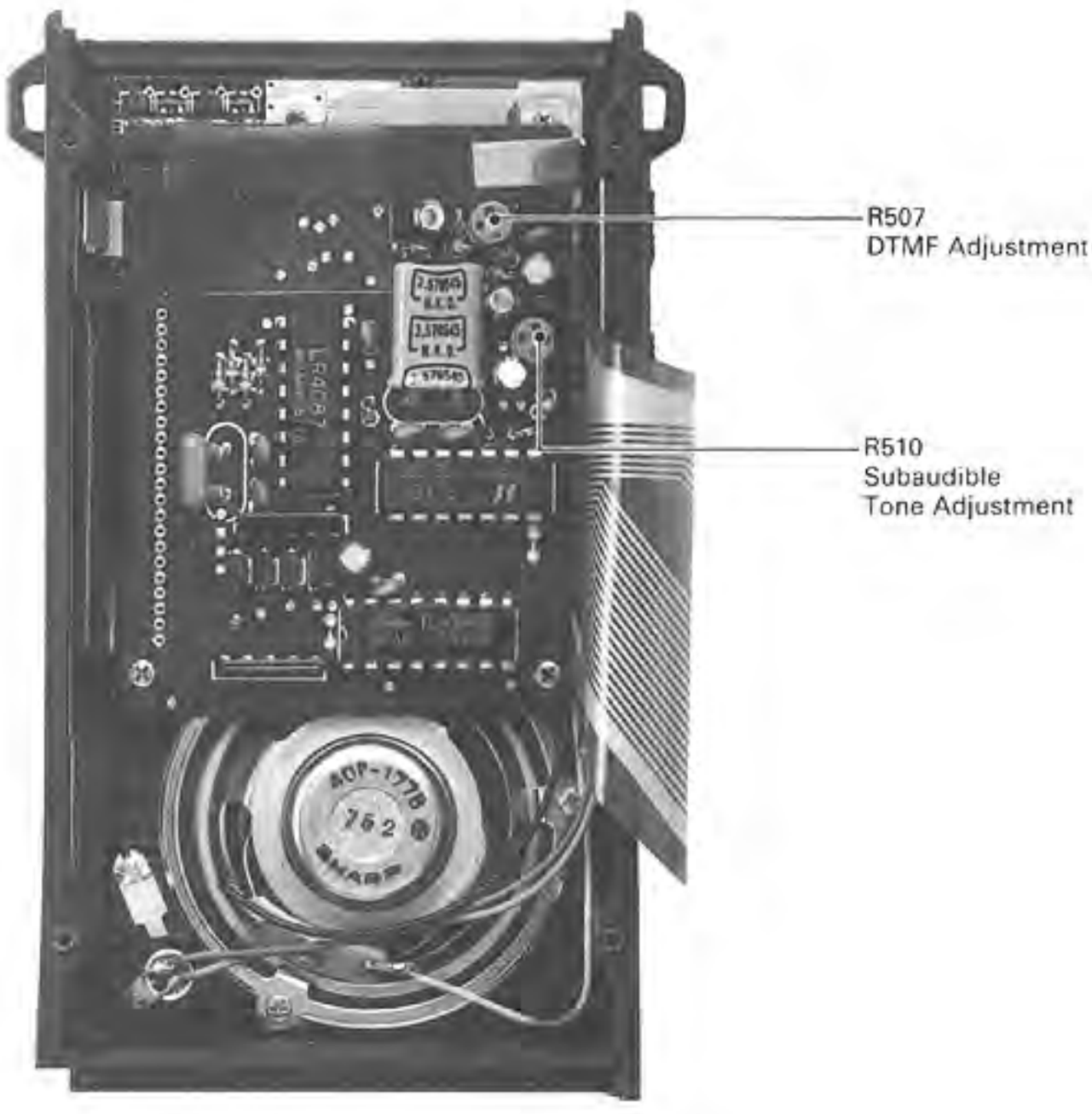

R267
R269
Output
Power
Adjustment
R243 Deviation Adjustment

6 - 4 SUBAUDIBLE TONE AND DTMF ADJUSTMENTS

TEST INSTRUMENTS REQUIRED	MEASUREMENT CONNECTION LOCATION
(1) RF POWER METER (TERMINATED TYPE) • Measuring range : 0 ~ 10W • Frequency range : At least 250MHz • Impedance : 50Ω • SWR : Less than 1:1.2 (2) FM DEVIATION METER • Frequency range : At least 250MHz • Measuring range : 0 ~ ±10kHz (3) ATTENUATOR • Input power : At least 5W • Attenuation : 20dB or 30dB (4) VOLTAGE REGULATED POWER SUPPLY • Output voltage : 13.2V DC • Current capacity : 2A	

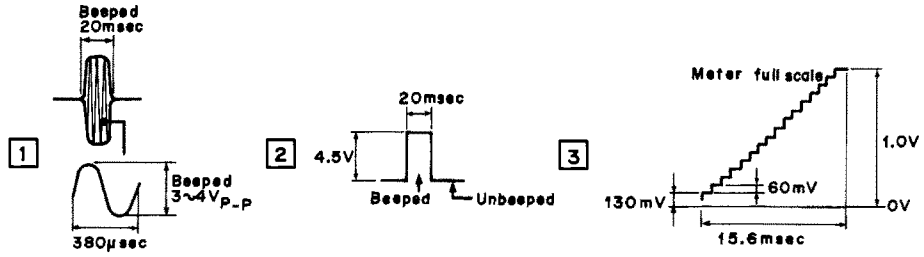
ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
SUBAUDIBLE TONE	1	• Operating frequency: 222.55MHz • Simplex mode • FM deviation meter: HPF (50Hz) OFF LPF (20Hz) ON • Tone number: 01 • Transmit mode	TOP PANEL	Connect an FM deviation meter to the ANTENNA CONNECTOR via an attenuator.	±0.5kHz	TONE	R510
DTMF	1	• Operating frequency: 222.55MHz • Simplex mode • Transmit mode • Push and hold [D] key.	TOP PANEL	Connect an FM deviation meter to the ANTENNA CONNECTOR via an attenuator.	±3.5kHz	TONE	R507

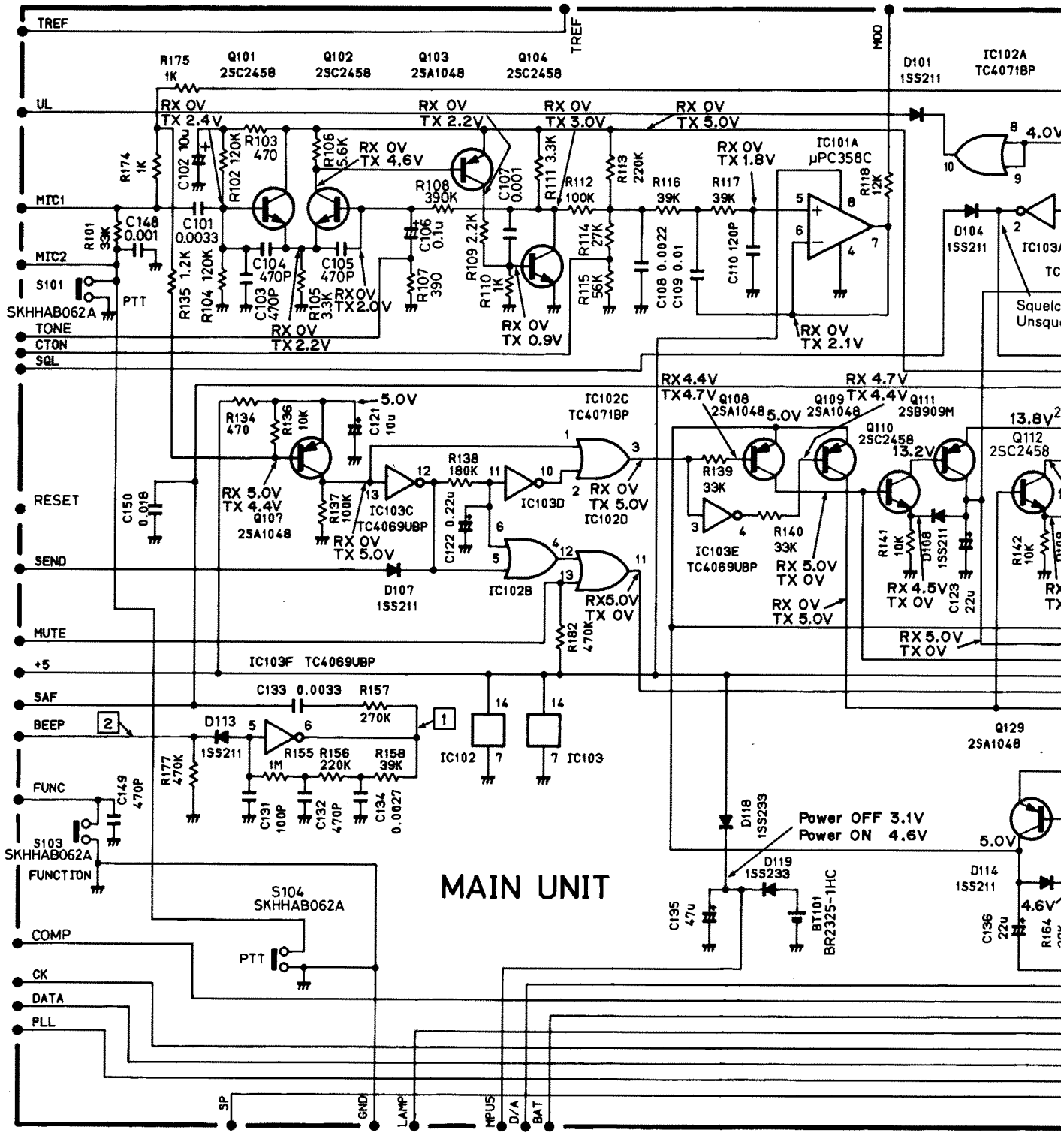
TONE UNIT

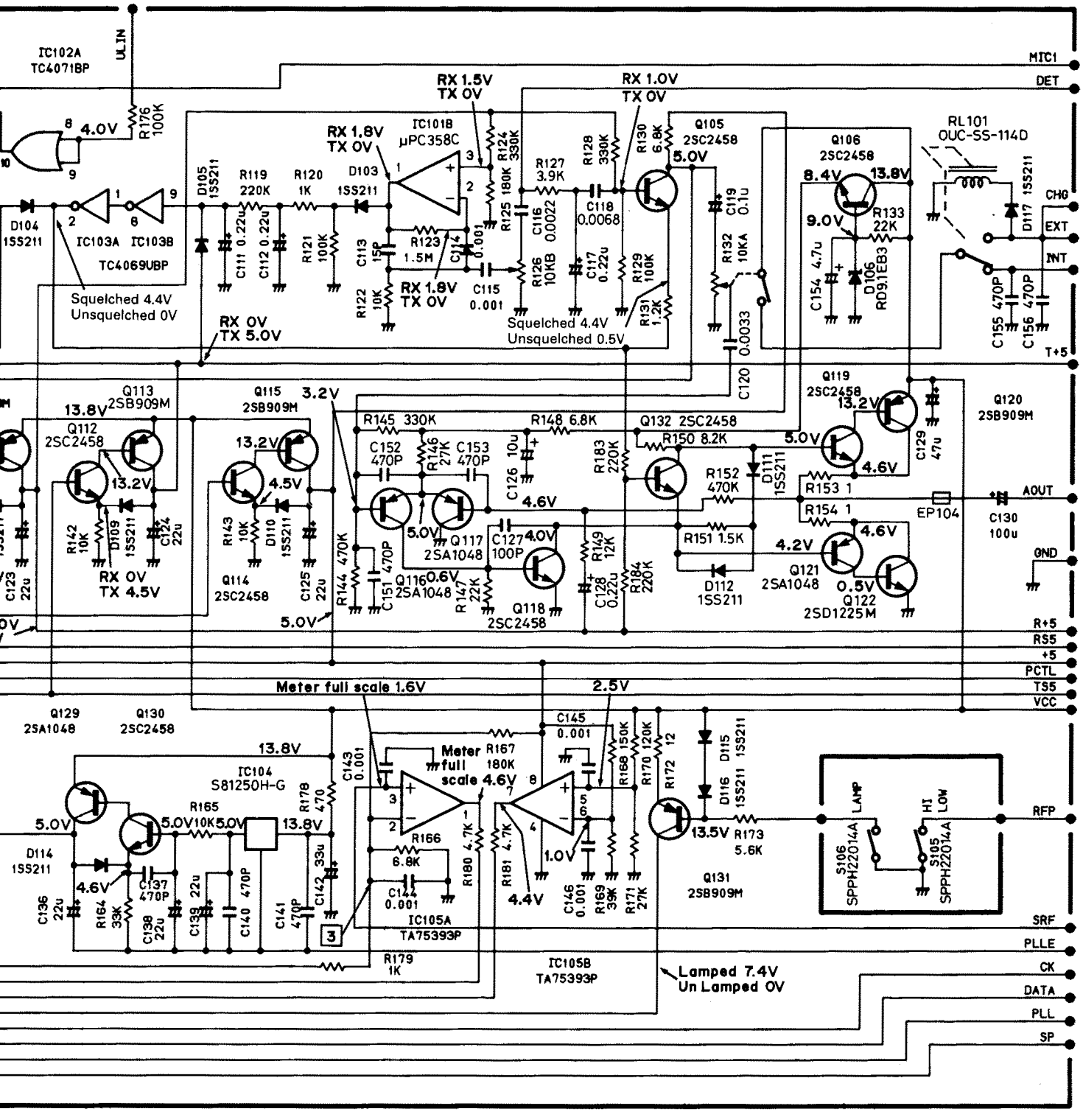


SECTION 7 VOLTAGE DIAGRAMS

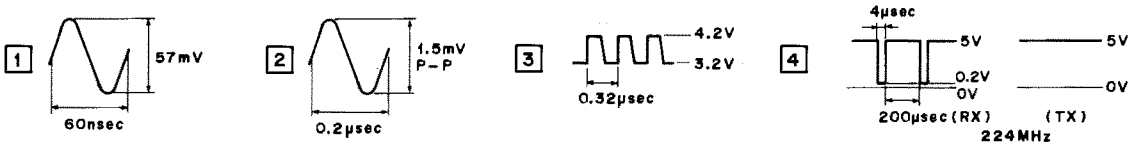
7 - 1 MAIN UNIT

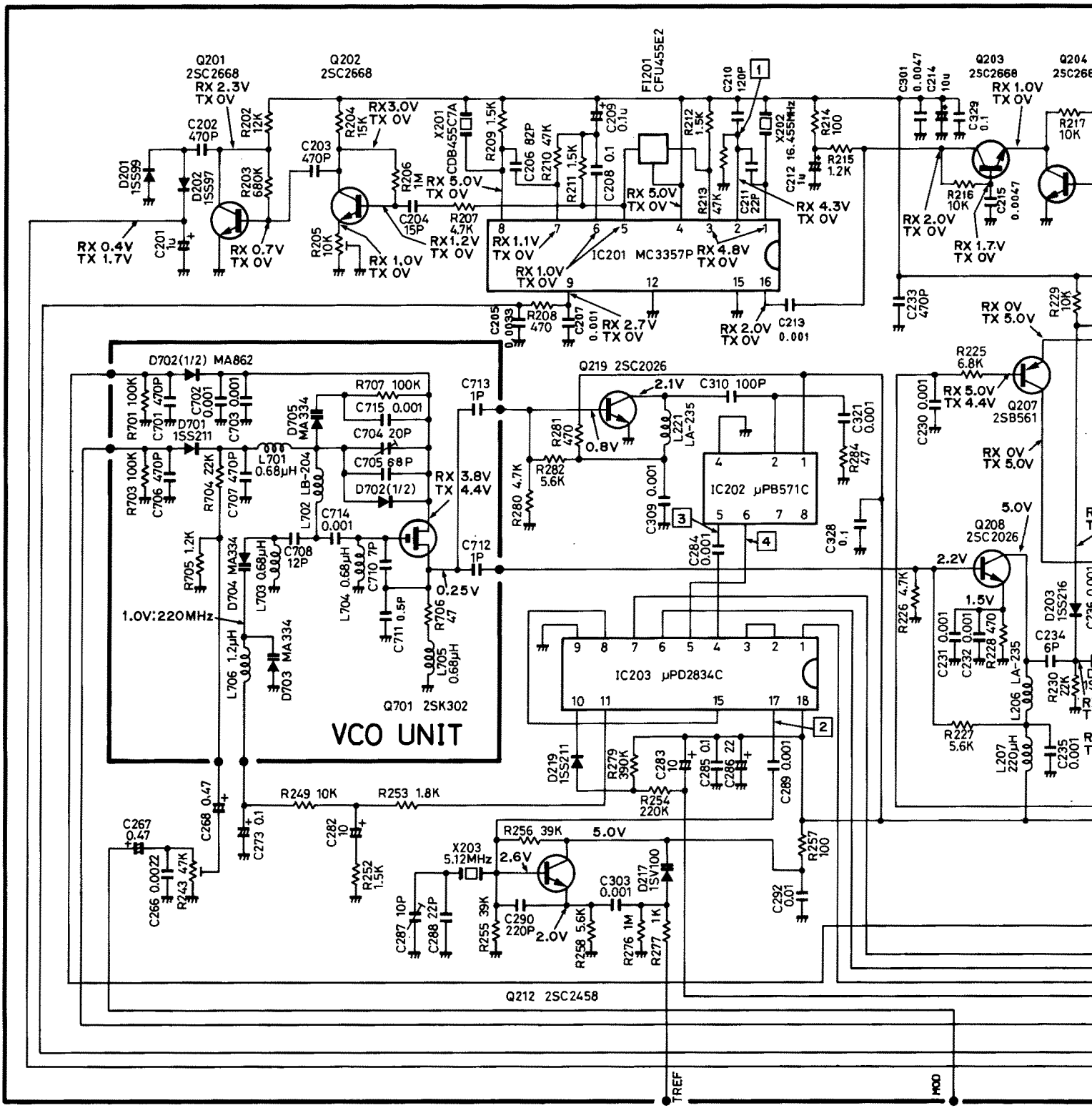


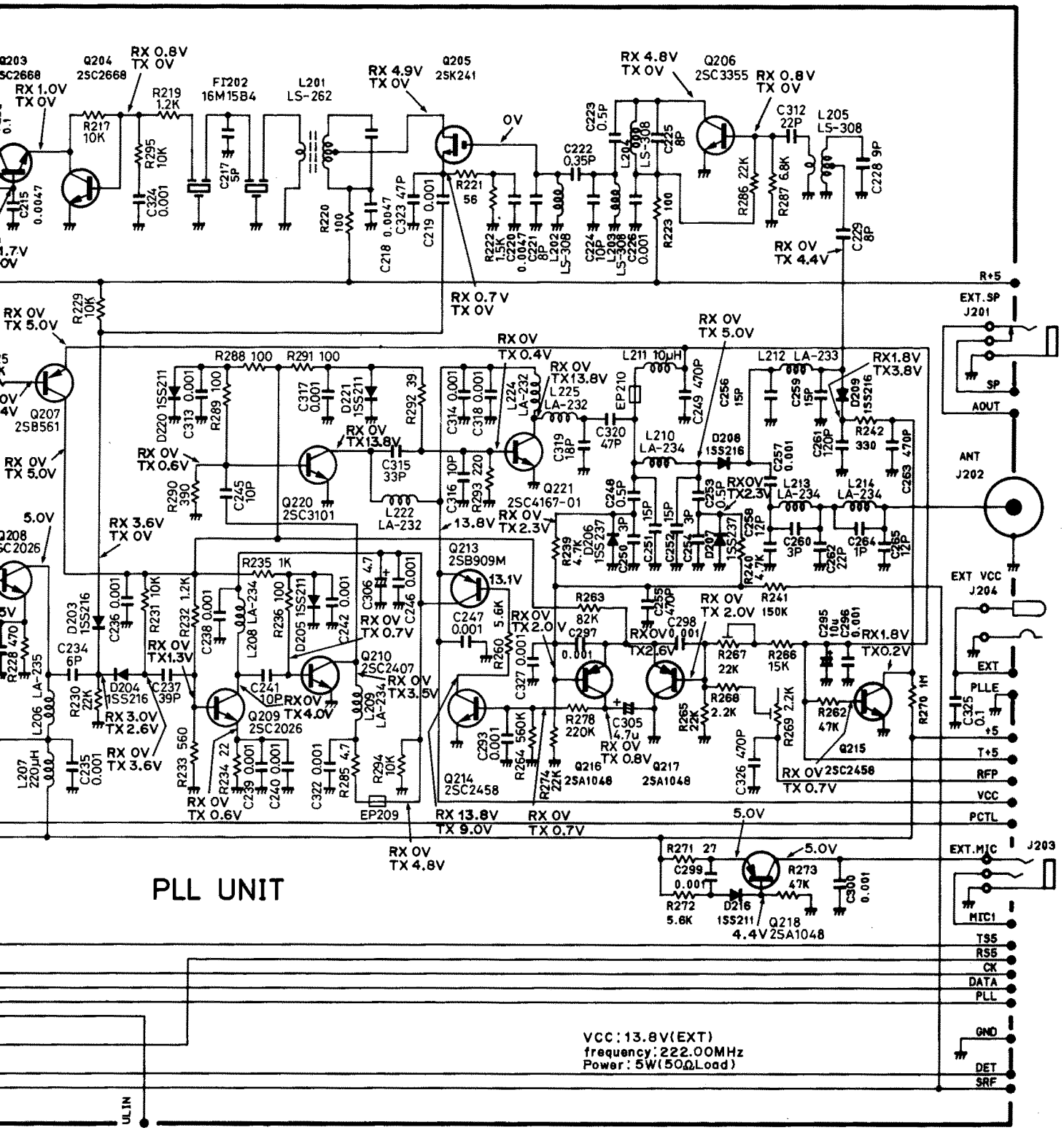



IC102A TC4071BP
ULIN
R176 100K
4.0V
MIC1
DET
RX 1.5V TX 0V
RX 1.0V TX 0V
RX 1.8V TX 0V
IC101B µPC358C
R124 330K
R125 180K
R127 3.9K
R128 330K
R130 6.8K
Q105 2SC2458
5.0V
RL101 OUC-SS-114D
Q106 2SC2458
8.4V
13.8V
9.0V
R133 22K
D117 1SS211
CHG
EXT
INT
D104 1SS211
IC103A IC103B TC4069UBP
D105 1SS211
R119 220K
R120 1K
D103 1SS211
C111 0.22u
C112 0.22u
R121 100K
C113 15P
R123 1.5M
C114 0.001
R122 10K
C115 0.001
C116 0.0022
R126 10KB
C117 0.22u
C118 0.0068
R129 100K
R131 1.2K
C119 0.1u
R132 10KA
C120 0.0033
C154 4.7u
D106 RD9.1EB3
C155 470P
C156 470P
T+5
Squelched 4.4V Unsquelched 0V
RX 0V TX 5.0V
Squelched 4.4V Unsquelched 0.5V
Q113 2SB909M
13.8V
Q112 2SC2458
13.2V
Q115 2SB909M
3.2V
13.2V
4.5V
R145 330K
R148 6.8K
Q132 2SC2458
R150 8.2K
Q119 2SC2458
13.2V
Q120 2SB909M
C152 470P
R146 27K
C153 470P
C126 10u
R183 220K
5.0V
4.6V
C129 47u
R142 10K
D109 1SS211
C124 22u
R143 10K
D110 1SS211
C125 22u
R144 470K
C151 470P
R147 22K
C128 0.22u
R149 12K
R184 220K
R152 470K
D111 1SS211
R153 1
R154 1
EP104
C130 100u
AOUT
GND
RX 0V TX 4.5V
Q114 2SC2458
Q116 2SA1048
Q117 2SA1048
Q118 2SC2458
4.6V
0.6V
5.0V
4.0V
C127 100P
D112 1SS211
4.2V
Q121 2SA1048
0.5V
Q122 2SD1225M
R+5
RS5
+5
PCTL
TS5
VCC
Meter full scale 1.6V
2.5V
Q129 2SA1048
Q130 2SC2458
13.8V
IC104 S81250H-G
R178 470
C143 0.001
Meter full scale
R167 180K
4.6V
C145 0.001
R168 150K
R170 120K
R172 12
D115 1SS211
D116 1SS211
5.0V
R165 10K
5.0V
5.0V
13.8V
R166 6.8K
R180 4.7K
R181 4.7K
1.0V
4.4V
C146 0.001
R169 39K
R171 27K
13.5V
R173 5.6K
Q131 2SB909M
S106 SPPH22014A
LAMP
HI
LOW
S105 SPPH22014A
RFP
D114 1SS211
4.6V
C136 22u
R164 33K
C137 470P
C138 22u
C139 22u
C140 470P
C141 470P
C142 33u
C144 0.001
IC105A TA75393P
IC105B TA75393P
R179 1K
Lamped 7.4V Un Lamped 0V
SRF
PLLE
CK
DATA
PLL
SP

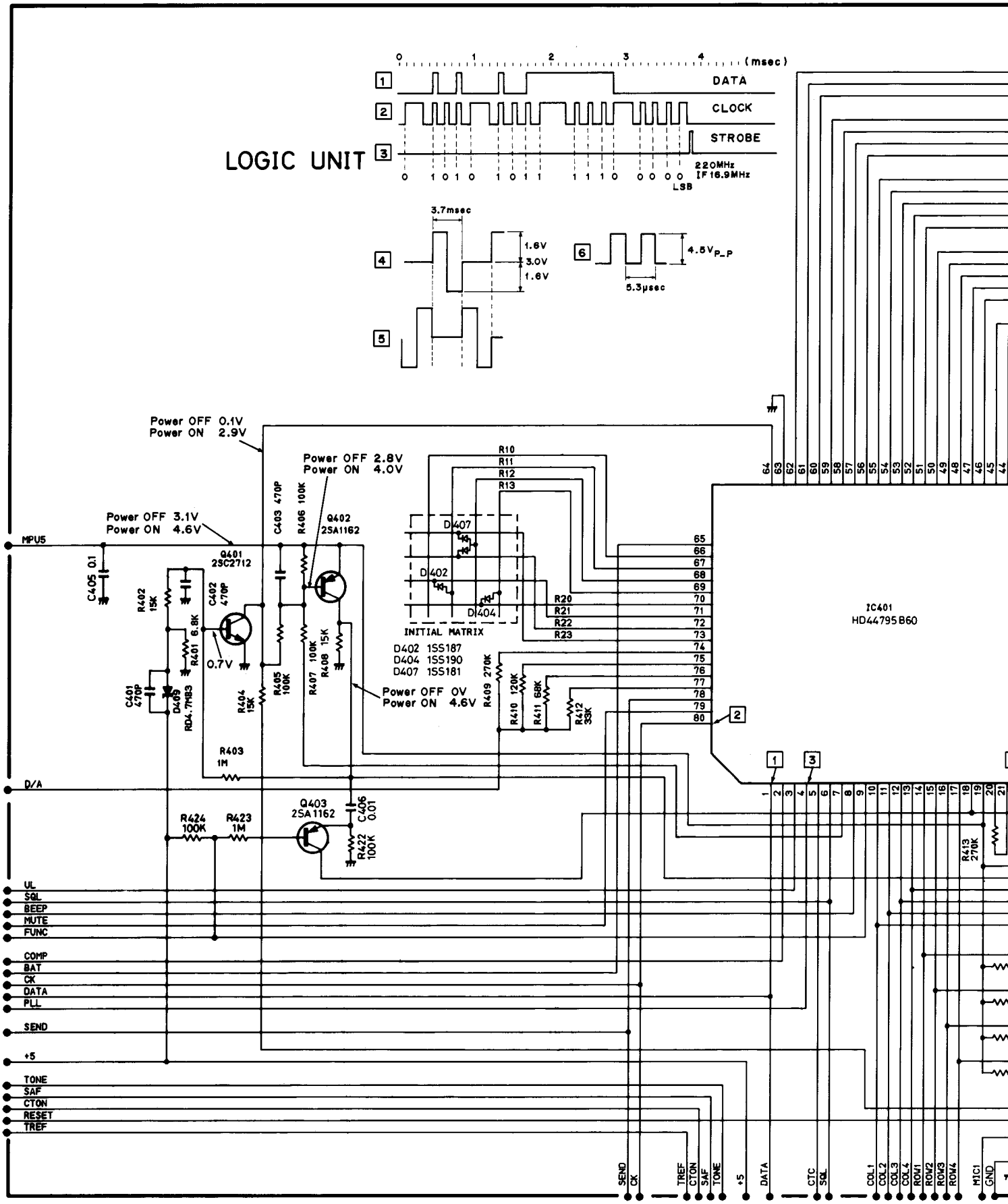
7 - 2 PLL, VCO UNITS

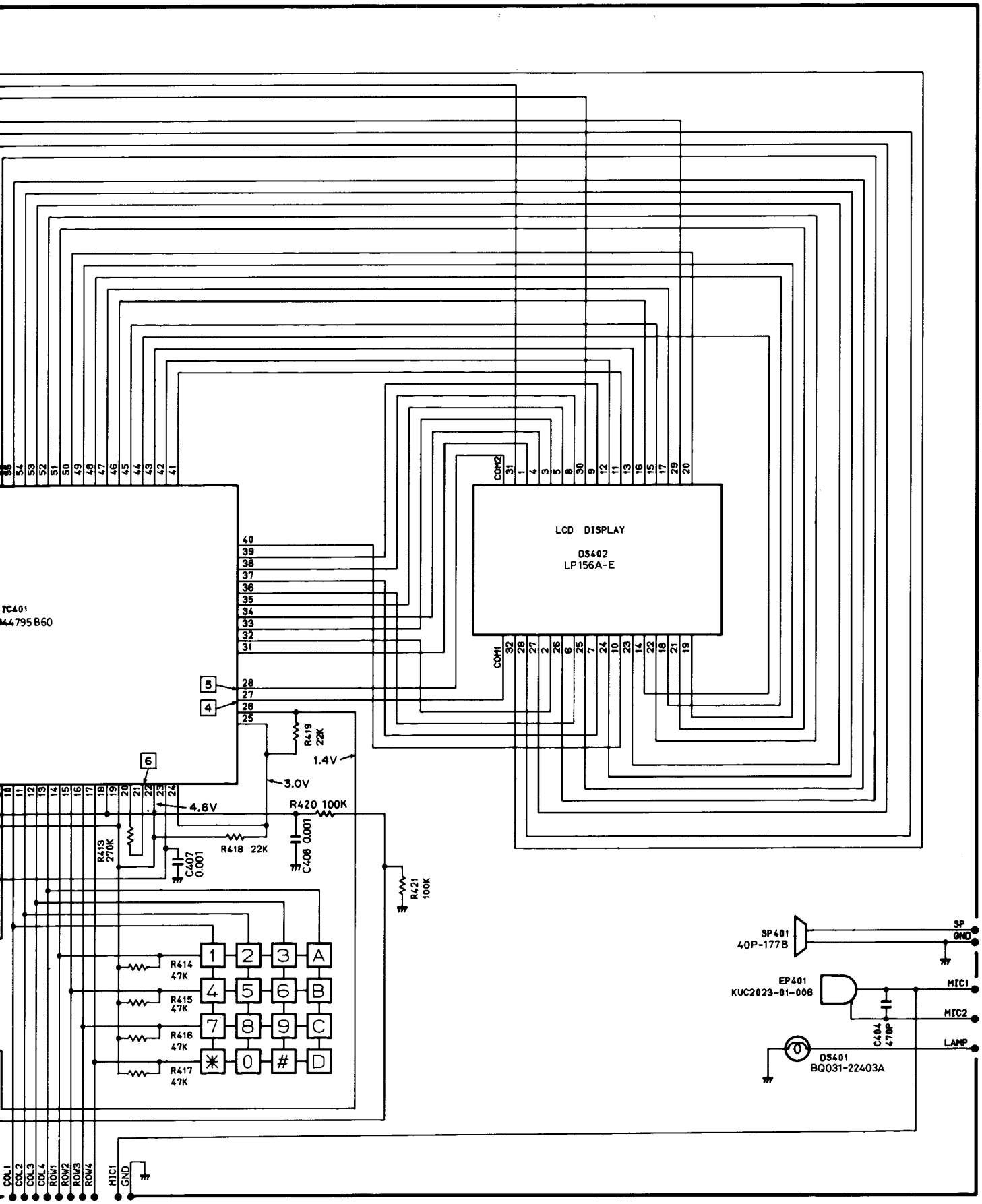




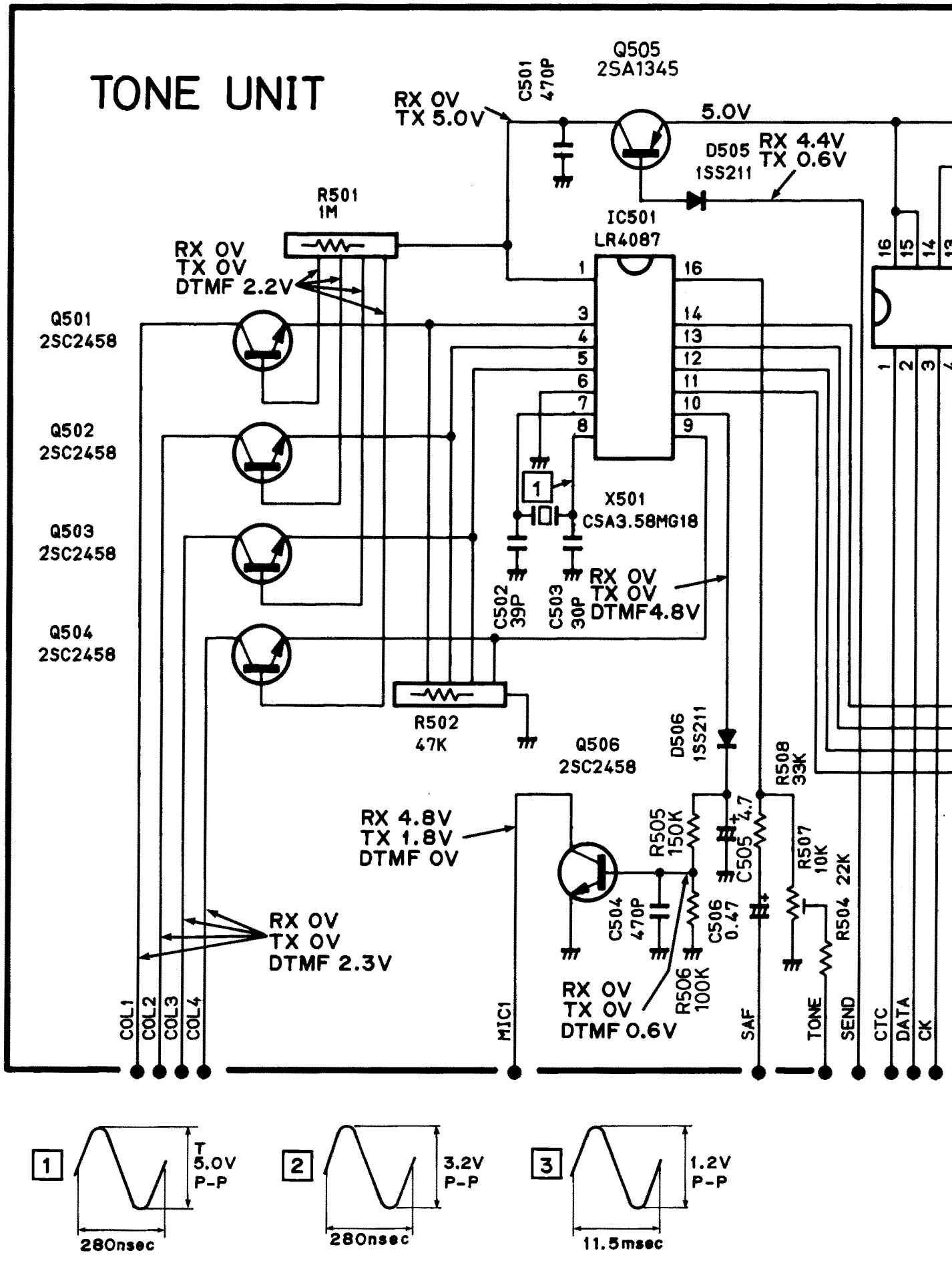

PLL UNIT
VCC: 13.8V(EXT)
frequency: 222.00MHz
Power: 5W(50ΩLoad)
EXT.SP J201
ANT J202
EXT VCC J204
EXT.MIC J203
R+5
SP
AOUT
EXT
PLLE
+5
T+5
RFP
VCC
PCTL
MIC1
TS5
RS5
CK
DATA
PLL
GND
DET
SRF
ULIN
Q203 2SC2668
Q204 2SC2668
Q205 2SK241
Q206 2SC3355
Q207 2SB561
Q208 2SC2026
Q209 2SC2026
Q210 2SC2407
Q213 2SB909M
Q214 2SC2458
Q215 2SC2458
Q216 2SA1048
Q217 2SA1048
Q218 2SA1048
Q220 2SC3101
Q221 2SC4167-01
FI202 16M15B4
L201 LS-262
L202 LS-308
L203 LS-308
L204 LS-308
L205 LS-308
L206 LA-235
L207 220μH
L208 LA-234
L209 LA-234
L210 LA-234
L211 10μH
L212 LA-233
L213 LA-234
L214 LA-234
L222 LA-232
L224 LA-232
L225 LA-232
D203 1SS216
D204 1SS216
D205 1SS211
D206 1SS237
D207 1SS237
D208 1SS216
D209 1SS216
D216 1SS211
D220 1SS211
D221 1SS211
EP209
EP210
RX 0.8V TX 0V
RX 1.0V TX 0V
RX 4.9V TX 0V
RX 4.8V TX 0V
RX 0.8V TX 0V
RX 0V TX 4.4V
RX 0.7V TX 0V
RX 0V TX 5.0V
RX 0V TX 0.4V
RX 0V TX13.8V
RX 0V TX 0.6V
RX 0V TX13.8V
RX 0V TX 5.0V
RX 0V TX 2.3V
RX1.8V TX3.8V
RX 3.6V TX 0V
RX 0V TX 0.7V
RX 0V TX1.3V
RX 0V TX 2.0V
RX 0V TX2.6V
RX 0V TX 2.0V
RX1.8V TX0.2V
RX 0V TX3.5V
RX 3.0V TX2.6V
RX 0V TX4.0V
RX 0V TX 3.6V
RX 0V TX 0.6V
RX 13.8V TX 9.0V
RX 0V TX 0.7V
RX 0V TX 4.8V
RX 0V TX 0.7V
5.0V
13.1V
4.4V

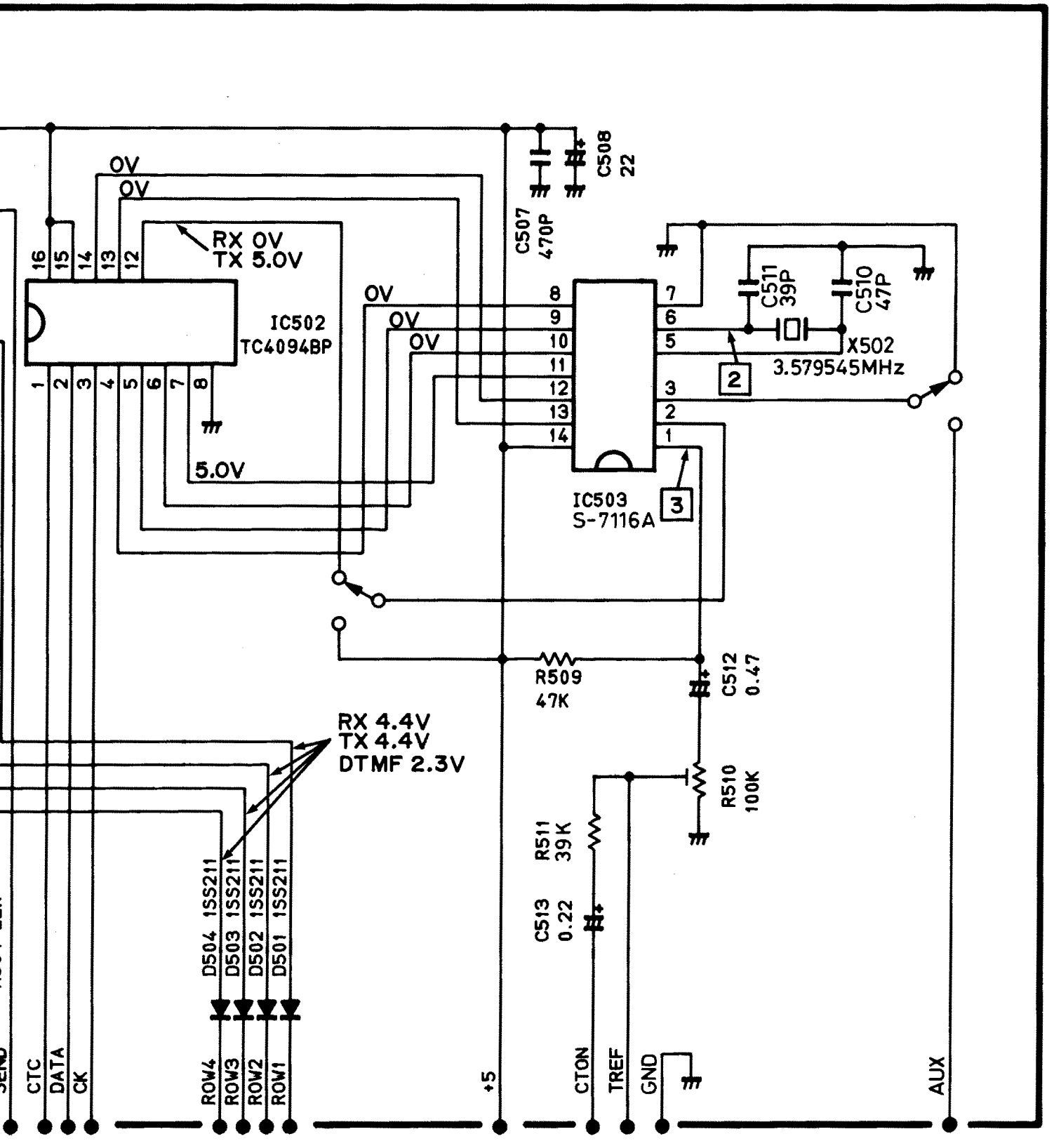
7 - 3 LOGIC UNIT




LCD DISPLAY
DS402
LP156A-E
COM2
COM1
RC401
44795B60
R419 22K
1.4V
3.0V
4.6V
R420 100K
R418 22K
R413 270K
C407 0.001
C408 0.001
R421 100K
R414 47K
R415 47K
R416 47K
R417 47K
SP401
40P-177B
SP
GND
EP401
KUC2023-01-006
MIC1
MIC2
C404 470P
LAMP
DS401
BQ031-22403A
COL1
COL2
COL3
COL4
ROW1
ROW2
ROW3
ROW4
MIC1
GND

7 - 4 TONE UNIT


TONE UNIT
RX 0V
TX 5.0V
C501
470P
Q505
2SA1345
5.0V
D505
1SS211
RX 4.4V
TX 0.6V
R501
1M
IC501
LR4087
RX 0V
TX 0V
DTMF 2.2V
Q501
2SC2458
Q502
2SC2458
Q503
2SC2458
Q504
2SC2458
X501
CSA3.58MG18
C502
39P
C503
30P
RX 0V
TX 0V
DTMF4.8V
R502
47K
Q506
2SC2458
D506
1SS211
R508
33K
RX 4.8V
TX 1.8V
DTMF 0V
R505
150K
C505
4.7
R507
10K
C504
470P
C506
0.47
R504
22K
RX 0V
TX 0V
DTMF 2.3V
R506
100K
RX 0V
TX 0V
DTMF 0.6V
COL1
COL2
COL3
COL4
MIC1
SAF
TONE
SEND
CTC
DATA
CK
1
T
5.0V
P-P
280nsec
2
3.2V
P-P
280nsec
3
1.2V
P-P
11.5msec



NOTE: TONE NO. 08 88.5Hz

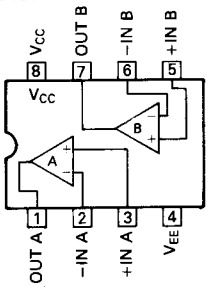
SECTION 8 BOARD LAYOUTS

8 - 1 MAIN UNIT

• ICs

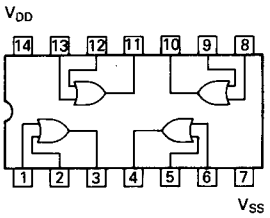
μPC358C
(Dual Driver)

IC101



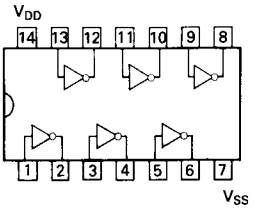
TC4071BP
(Quad 2-Input OR Gate)

IC102



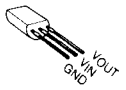
TC4069UBP
(Hex Inverter)

IC103



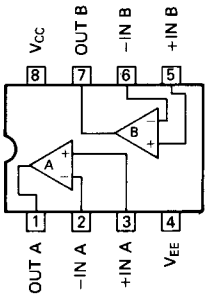
S81250H-G
(3-Terminal Voltage Regulator)

IC104



TA75393P
(Dual Comparator)

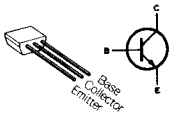
IC105



• Transistors

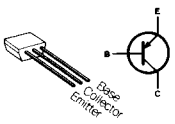
2SC2458 GR

Q101, Q102, Q104, Q105
Q106, Q110, Q112, Q114
Q118, Q119, Q130, Q132



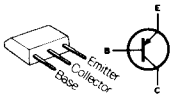
2SA1048 GR

Q103, Q107, Q108, Q109
Q116, Q117, Q121, Q129



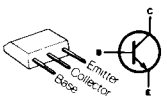
2SB909M R

Q111, Q113, Q115, Q120
Q131

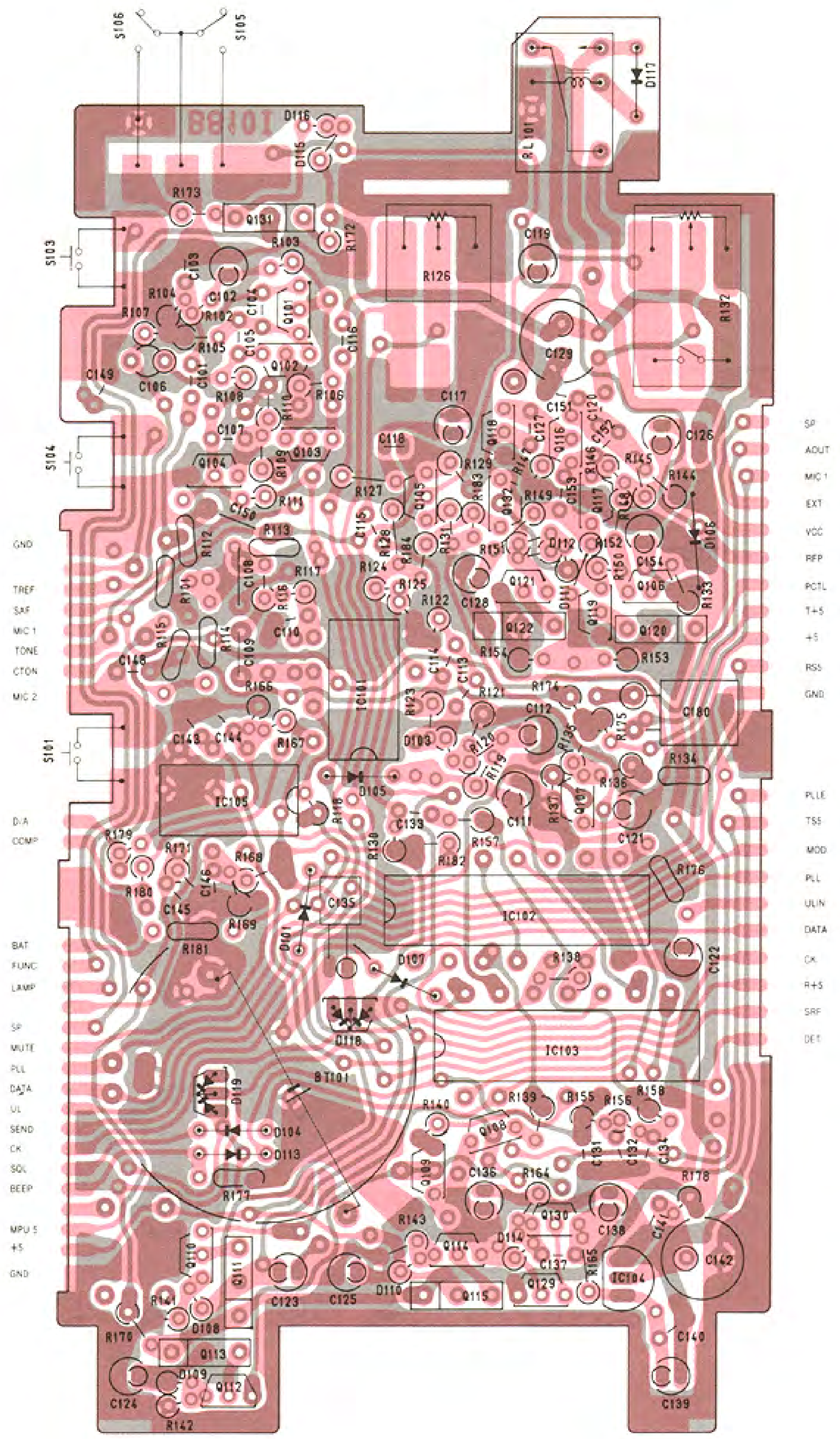


2SD1225M R

Q122



MAIN UNIT

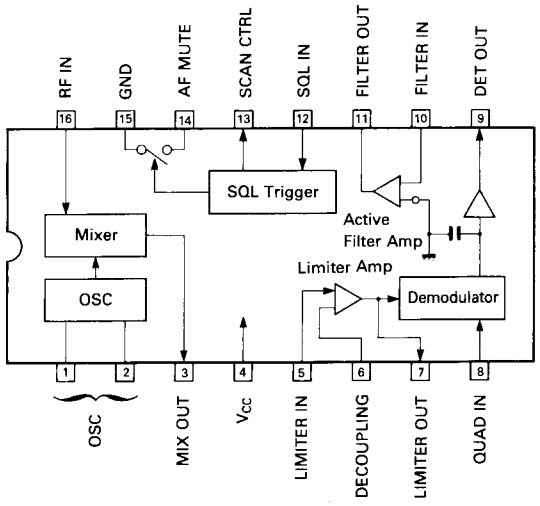

S106
S105
S103
S104
S101
D116
D115
D117
RL101
R173
Q131
R172
R103
C103
R104
C102
R107
R102
C104
Q101
R105
C105
C116
C149
C106
C101
Q102
R108
R110
R106
C107
Q104
R109
Q103
R111
C150
R113
R112
R101
C108
R117
R116
R115
R114
C110
C109
C148
R166
C143
C144
R167
IC105
IC101
R118
D105
R179
R171
R168
R180
C146
C145
R169
R181
C135
D101
D107
D118
BT101
D119
D104
D113
R177
Q110
Q111
R141
D108
R170
Q113
C124
D109
Q112
R142
C123
C125
D110
Q115
Q114
R143
D114
C137
Q129
R165
IC104
C142
C141
C140
C139
Q130
C138
C136
R164
Q109
Q108
R140
R139
R155
R156
R158
C131
C132
C134
R178
IC103
IC102
R138
C122
R176
C121
R136
R137
Q107
C111
R157
R182
R130
C133
R134
C180
R175
R135
C112
R174
R121
R120
R119
D103
R123
C114
C113
R154
R153
Q122
Q120
R122
C128
R125
R124
R184
R128
C115
R131
R151
Q121
D112
D111
Q119
R152
R150
C154
Q106
R133
D106
R144
R145
R148
Q117
C153
R149
Q132
R183
R129
Q105
R127
C118
C117
Q118
R147
C127
Q116
C151
C120
C152
R146
C126
C129
C119
R126
R132
GND
TREF
SAF
MIC 1
TONE
CTON
MIC 2
D/A
COMP
BAT
FUNC
LAMP
SP
MUTE
PLL
DATA
UL
SEND
CK
SQL
BEEP
MPU 5
+5
GND
SP
AOUT
MIC 1
EXT
VCC
RFP
PCTL
T+5
+5
RS5
GND
PLLE
TS5
MOD
PLL
ULIN
DATA
CK
R+5
SRF
DET

8 - 2 PLL UNIT

• ICs

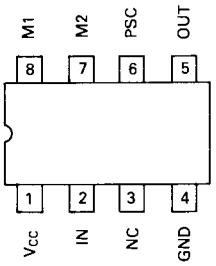
MC3357P (Low Power FM IF)

IC201



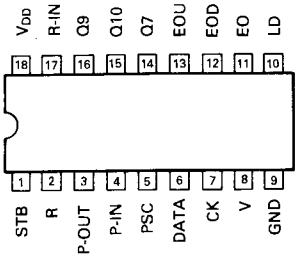
μPB571C (Low Power Prescaler)

IC202



μPD2834C (PLL Frequency Synthesizer)

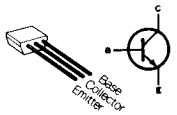
IC203



• Transistors

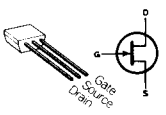
2SC2668 O

Q201, Q202, Q203, Q204



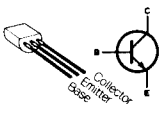
2SK241 Y

Q205



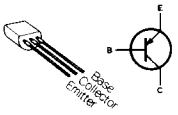
2SC3355

Q206



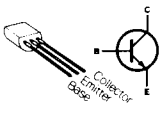
2SB561 C

Q207



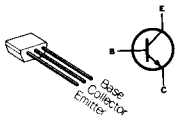
2SC2407 A

Q210



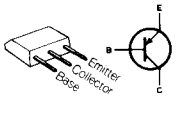
2SC2458 GR

Q212, Q214, Q215



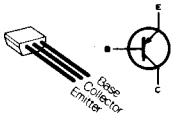
2SB909M R

Q213



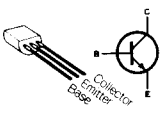
2SA1048 GR

Q216, Q217, Q218



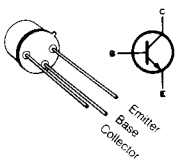
2SC2026

Q219



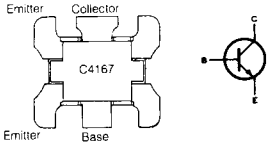
2SC3101

Q220

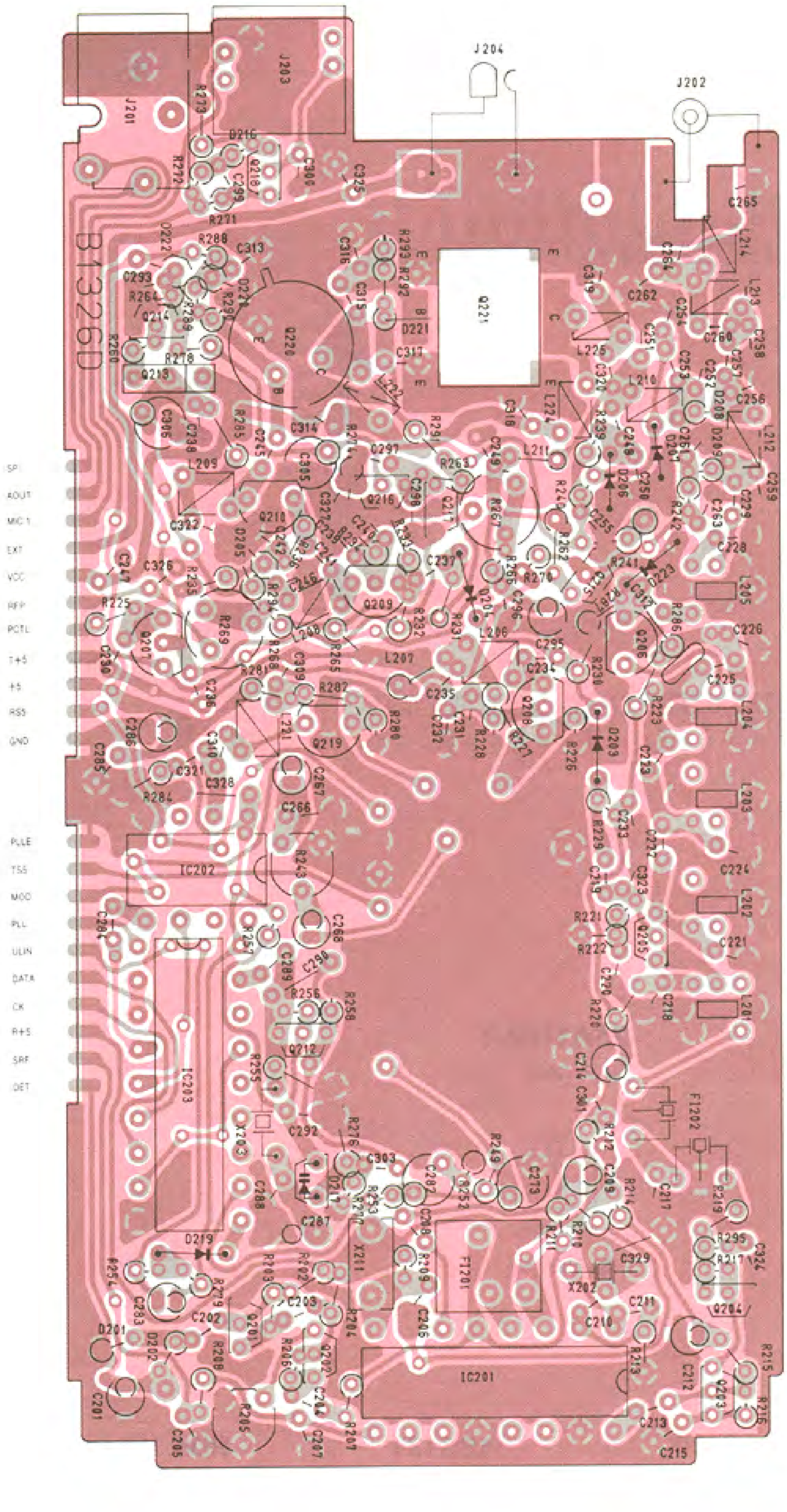


2SC4167-01

Q221



PLL UNIT

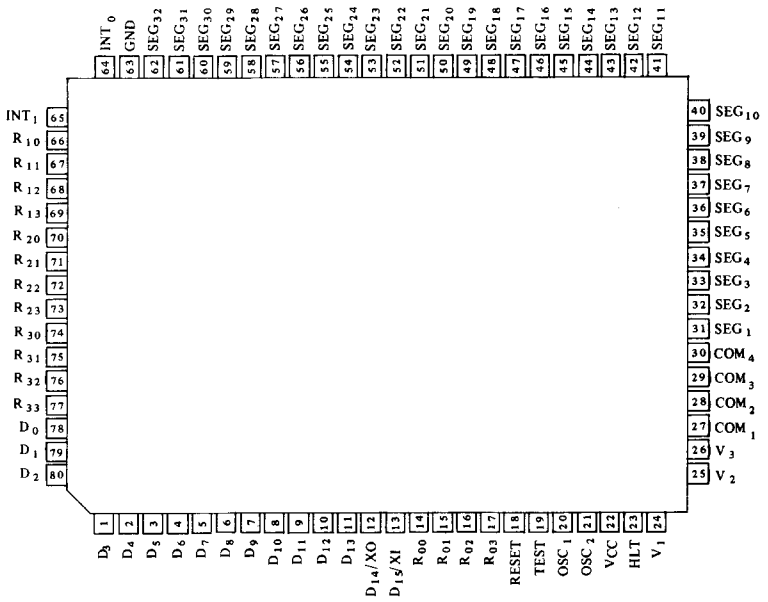

J204
J202
J201
J203
B1326D
Q221
IC201
IC202
IC203
SP
AOUT
MIC 1
EXT
VCC
RFP
PCTL
T+5
+5
RS5
GND
PLLE
TSS
MOD
PLL
ULIN
DATA
CK
R+5
SRF
DET

8 - 3 LOGIC UNIT

• IC

HD44795B60 (MPU)

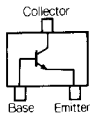
IC401



• Transistors

2SC2712 Y

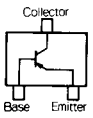
Q401



Symbol: LY

2SA1162 Y

Q402, Q403

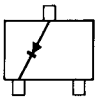


Symbol: SY

• Diodes

1SS187

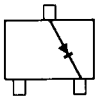
D402



Symbol: D3

1SS190

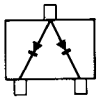
D404



Symbol: E3

1SS181

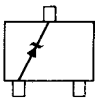
D407



Symbol: A3

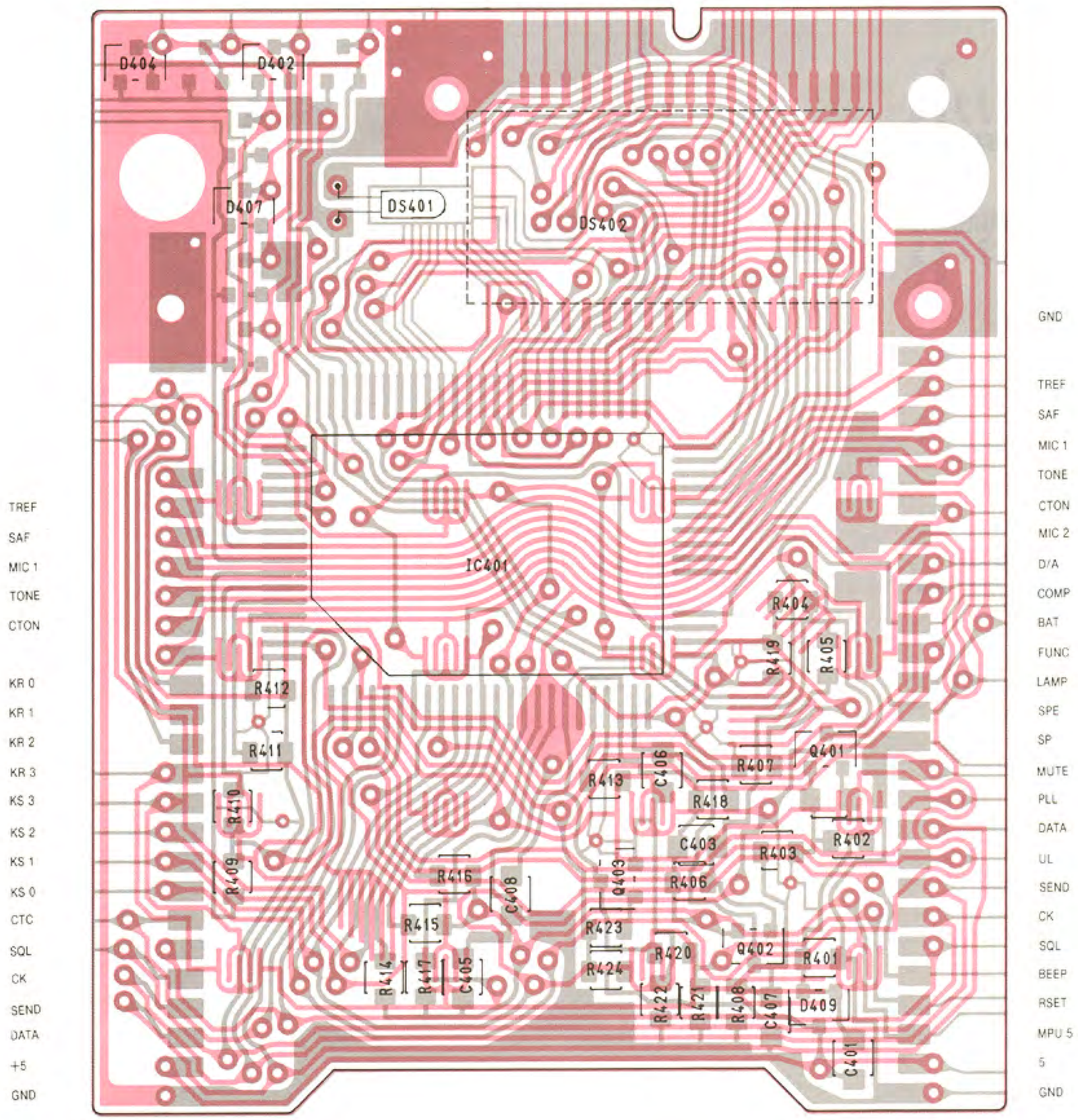
RD4.7M B3

D409



Symbol: 4$\bar{7}$3

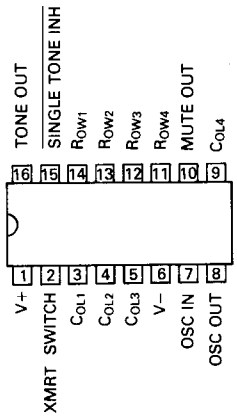
LOGIC UNIT


D404
D402
D407
DS401
DS402
IC401
R412
R411
R410
R409
R416
C408
R415
R414
R417
C405
R413
C406
R407
Q401
R418
C403
R403
R402
Q403
R406
R423
R424
R420
Q402
R401
R422
R421
R408
C407
D409
C401
R404
R419
R405
TREF
SAF
MIC 1
TONE
CTON
KR 0
KR 1
KR 2
KR 3
KS 3
KS 2
KS 1
KS 0
CTC
SQL
CK
SEND
DATA
+5
GND
GND
TREF
SAF
MIC 1
TONE
CTON
MIC 2
D/A
COMP
BAT
FUNC
LAMP
SPE
SP
MUTE
PLL
DATA
UL
SEND
CK
SQL
BEEP
RSET
MPU 5
5
GND

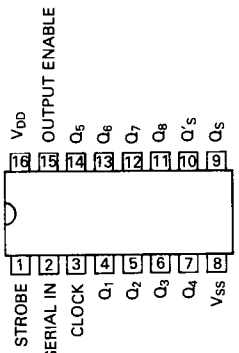
8 - 4 TONE UNIT

• ICs

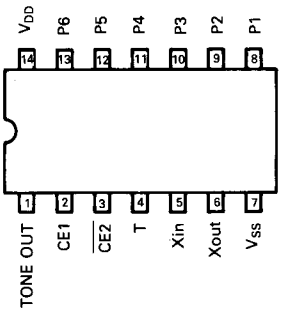
LR4087
(DTMF Encoder)
IC501



TC4094BP
(8-Stage Shift-and-Store Bus Register)
IC502

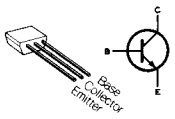


S-7116A
(Subaudible Tone Encoder)
IC503

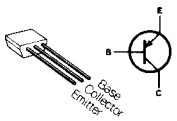


• Transistors

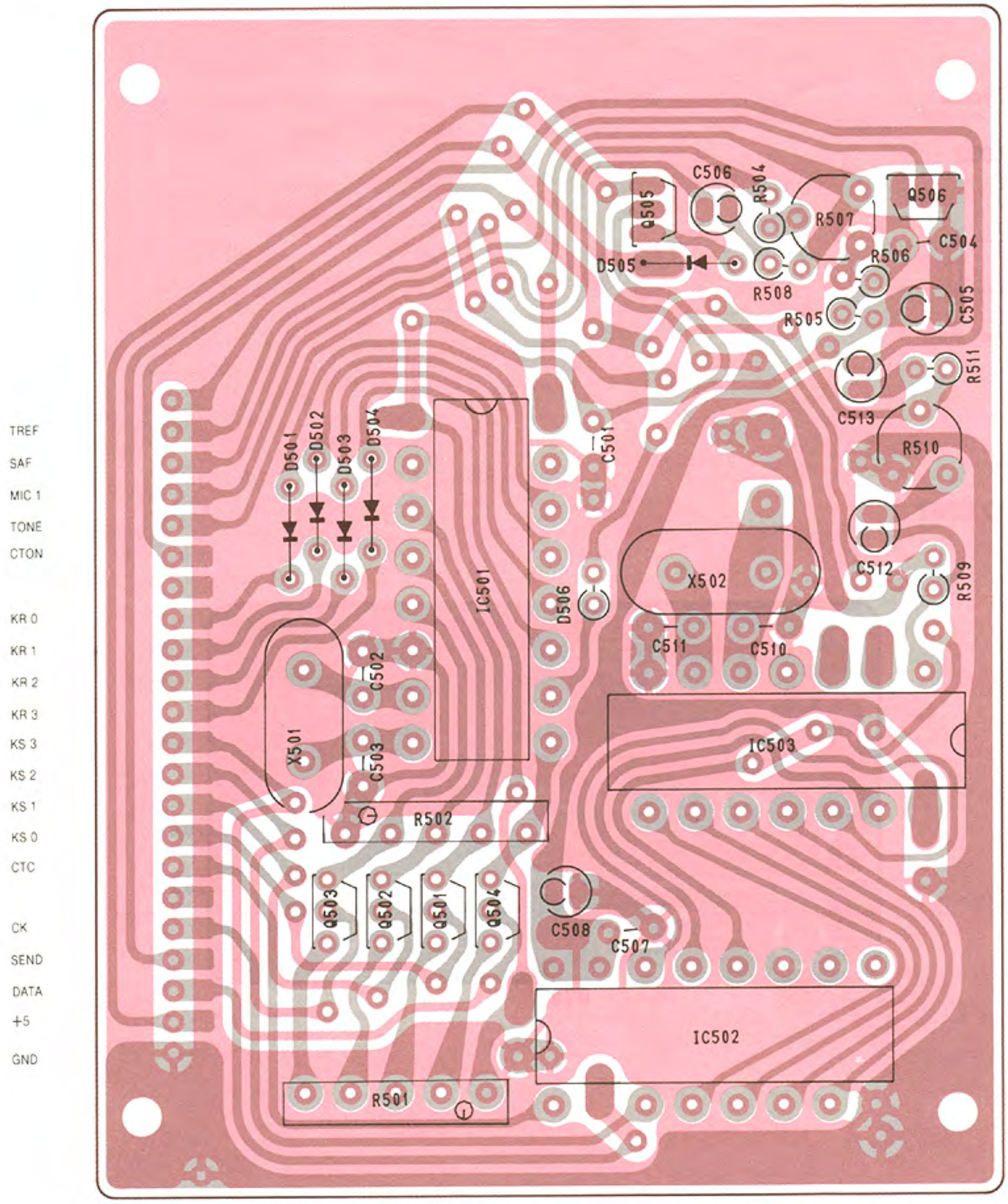
2SC2458 GR
Q501, Q502, Q503, Q504
Q506



2SA1345
Q505



TONE UNIT


TREF
SAF
MIC 1
TONE
CTON
KR 0
KR 1
KR 2
KR 3
KS 3
KS 2
KS 1
KS 0
CTC
CK
SEND
DATA
+5
GND
D501
D502
D503
D504
C501
IC501
D506
Q505
C506
R504
R507
Q506
C504
D505
R506
R508
R505
C505
R511
C513
R510
C512
R509
X502
C511
C510
IC503
X501
C502
C503
R502
Q503
Q502
Q501
Q504
C508
C507
IC502
R501

8 - 5 VCO UNIT

- **Transistor**

2SK302 Y

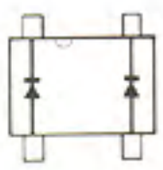
Q701

Symbol: TY

- **Diode**

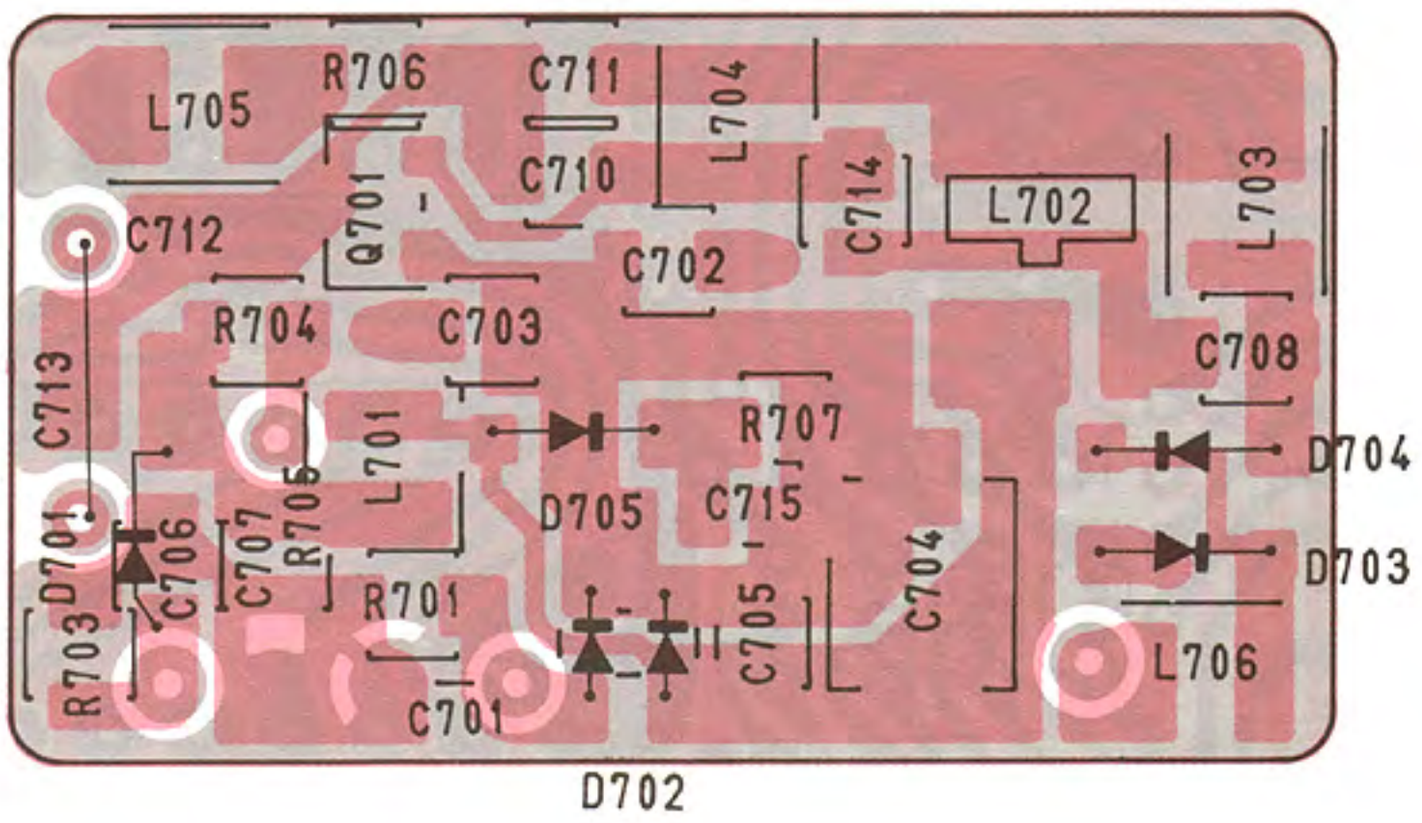
MA862

D702



Symbol: M1I

VCO UNIT



SECTION 9 PARTS LIST

MAIN UNIT

REF. NO.	DESCRIPTION	PART NO.	
IC101	IC	μPC358C	
IC102	IC	TC4071BP	
IC103	IC	TC4069UBP	
IC104	IC	S81250H-G	
IC105	IC	TA75393P	
Q101	Transistor	2SC2458 GR	
Q102	Transistor	2SC2458 GR	
Q103	Transistor	2SA1048 GR	
Q104	Transistor	2SC2458 GR	
Q105	Transistor	2SC2458 GR	
Q106	Transistor	2SC2458 GR	
Q107	Transistor	2SA1048 GR	
Q108	Transistor	2SA1048 GR	
Q109	Transistor	2SA1048 GR	
Q110	Transistor	2SC2458 GR	
Q111	Transistor	2SB909M R	
Q112	Transistor	2SC2458 GR	
Q113	Transistor	2SB909M R	
Q114	Transistor	2SC2458 GR	
Q115	Transistor	2SB909M R	
Q116	Transistor	2SA1048 GR	
Q117	Transistor	2SA1048 GR	
Q118	Transistor	2SC2458 GR	
Q119	Transistor	2SC2458 GR	
Q120	Transistor	2SB909M R	
Q121	Transistor	2SA1048 GR	
Q122	Transistor	2SD1225M R	
Q129	Transistor	2SA1048 GR	
Q130	Transistor	2SC2458 GR	
Q131	Transistor	2SB909M R	
Q132	Transistor	2SC2458 GR	
D101	Diode	1SS211	
D103	Diode	1SS211	
D104	Diode	1SS211	
D105	Diode	1SS211	
D106	Zener	RD9.1E B3	
D107	Diode	1SS211	
D108	Diode	1SS211	
D109	Diode	1SS211	
D110	Diode	1SS211	
D111	Diode	1SS211	
D112	Diode	1SS211	
D113	Diode	1SS211	
D114	Diode	1SS211	
D115	Diode	1SS211	
D116	Diode	1SS211	
D117	Diode	1SS211	
D118	Diode	1SS233	
D119	Diode	1SS233	
R101	Resistor	33kΩ	R10
R102	Resistor	120kΩ	ELR10
R103	Resistor	470Ω	ELR10
R104	Resistor	120kΩ	ELR10
R105	Resistor	3.3kΩ	ELR10
R106	Resistor	5.6kΩ	ELR10
R107	Resistor	390Ω	ELR10
R108	Resistor	390kΩ	ELR10
R109	Resistor	2.2kΩ	ELR10
R110	Resistor	1kΩ	ELR10
R111	Resistor	3.3kΩ	ELR10
R112	Resistor	100kΩ	R10
R113	Resistor	220kΩ	R10
R114	Resistor	27kΩ	R10
R115	Resistor	56kΩ	R10
R116	Resistor	39kΩ	ELR10
R117	Resistor	39kΩ	ELR10
R118	Resistor	12kΩ	ELR10
R119	Resistor	220kΩ	ELR10
R120	Resistor	1kΩ	ELR10

MAIN UNIT

REF. NO.	DESCRIPTION	PART NO.		
R121	Resistor	100kΩ	ELR10	
R122	Resistor	10kΩ	ELR10	
R123	Resistor	1.5MΩ	ELR20	
R124	Resistor	330kΩ	ELR10	
R125	Resistor	180kΩ	ELR10	
R126	Variable	10kΩB	RK094111000NA	
R127	Resistor	3.9kΩ	ELR10	
R128	Resistor	330kΩ	ELR10	
R129	Resistor	100kΩ	ELR10	
R130	Resistor	6.8kΩ	ELR10	
R131	Resistor	1.2kΩ	ELR10	
R132	Variable	10kΩA	RK0941111003A	
R133	Resistor	22kΩ	ELR10	
R134	Resistor	470Ω	R10	
R135	Resistor	1.2kΩ	ELR10	
R136	Resistor	10kΩ	ELR10	
R137	Resistor	100kΩ	ELR10	
R138	Resistor	180kΩ	ELR10	
R139	Resistor	33kΩ	ELR10	
R140	Resistor	33kΩ	ELR10	
R141	Resistor	10kΩ	ELR10	
R142	Resistor	10kΩ	ELR10	
R143	Resistor	10kΩ	ELR10	
R144	Resistor	470kΩ	ELR10	
R145	Resistor	330kΩ	ELR10	
R146	Resistor	27kΩ	ELR10	
R147	Resistor	22kΩ	ELR10	
R148	Resistor	6.8kΩ	ELR10	
R149	Resistor	12kΩ	ELR10	
R150	Resistor	8.2kΩ	ELR10	
R151	Resistor	1.5kΩ	ELR10	
R152	Resistor	470kΩ	ELR10	
R153	Resistor	1Ω	ELR10	
R154	Resistor	1Ω	ELR10	
R155	Resistor	1MΩ	ELR10	
R156	Resistor	220kΩ	ELR10	
R157	Resistor	270kΩ	ELR10	
R158	Resistor	39kΩ	ELR10	
R164	Resistor	33kΩ	ELR10	
R165	Resistor	10kΩ	ELR10	
R166	Resistor	6.8kΩ	ELR10	
R167	Resistor	180kΩ	ELR10	
R168	Resistor	150kΩ	ELR10	
R169	Resistor	39kΩ	ELR10	
R170	Resistor	120kΩ	ELR10	
R171	Resistor	27kΩ	ELR10	
R172	Resistor	12Ω	ELR10	
R173	Resistor	5.6kΩ	ELR10	
R174	Resistor	1kΩ	ELR10	
R175	Resistor	1kΩ	ELR10	
R176	Resistor	100kΩ	R10	
R177	Resistor	470kΩ	R10	
R178	Resistor	470Ω	ELR10	
R179	Resistor	1kΩ	ELR10	
R180	Resistor	4.7kΩ	ELR10	
R181	Resistor	4.7kΩ	R10	
R182	Resistor	470kΩ	ELR10	
R183	Resistor	220kΩ	ELR10	
R184	Resistor	220kΩ	ELR10	
C101	Barrier Layer	0.0033μF	25V	
C102	Electrolytic	10μF	16V	RC3
C103	Ceramic	470pF	50V	
C104	Ceramic	470pF	50V	
C105	Ceramic	470pF	50V	
C106	Tantalum	0.1μF	35V	DN
C107	Ceramic	0.001μF	50V	
C108	Mylar	0.0022μF	50V	
C109	Mylar	0.01μF	50V	
C110	Ceramic	120pF	50V	
C111	Electrolytic	0.22μF	50V	RC3
C112	Electrolytic	0.22μF	50V	RC3

MAIN UNIT

REF. NO.	DESCRIPTION	PART NO.		
C113	Ceramic	15pF	50V	
C114	Ceramic	0.001μF	50V	
C115	Ceramic	0.001μF	50V	
C116	Barrier Layer	0.0022μF	25V	
C117	Electrolytic	0.22μF	50V	RC3
C118	Barrier Layer	0.0068μF	25V	
C119	Electrolytic	0.1μF	50V	RC3
C120	Barrier Layer	0.0033μF	25V	
C121	Electrolytic	10μF	16V	RC3
C122	Electrolytic	0.22μF	50V	RC3
C123	Electrolytic	22μF	6.3V	RC3
C124	Electrolytic	22μF	6.3V	RC3
C125	Electrolytic	22μF	6.3V	RC3
C126	Electrolytic	10μF	16V	RC3
C127	Ceramic	100pF	50V	
C128	Electrolytic	0.22μF	50V	RC3
C129	Electrolytic	47μF	25V	MS7
C130	Electrolytic	100μF	10V	MS7
C131	Ceramic	100pF	50V	
C132	Ceramic	470pF	50V	
C133	Barrier Layer	0.0033μF	25V	
C134	Barrier Layer	0.0027μF	25V	
C135	Electrolytic	47μF	6.3V	RC3
C136	Electrolytic	22μF	6.3V	RC3
C137	Ceramic	470pF	50V	
C138	Electrolytic	22μF	6.3V	RC3
C139	Electrolytic	22μF	6.3V	RC3
C140	Ceramic	470pF	50V	
C141	Ceramic	470pF	50V	
C142	Electrolytic	33μF	25V	RC3
C143	Ceramic	0.001μF	50V	
C144	Ceramic	0.001μF	50V	
C145	Ceramic	0.001μF	50V	
C146	Ceramic	0.001μF	50V	
C148	Ceramic	0.001μF	50V	
C149	Ceramic	470pF	50V	
C150	Barrier Layer	0.018μF	25V	
C151	Ceramic	470pF	50V	
C152	Ceramic	470pF	50V	
C153	Ceramic	470pF	50V	
C154	Electrolytic	4.7μF	25V	RC3
C155	Ceramic	470pF	50V	
C156	Ceramic	470pF	50V	
RL101	Relay	OUC-SS-114D		
S101	Switch	SKHHAB062A		
S103	Switch	SKHHAB062A		
S104	Switch	SKHHAB062A		
S105	Switch	SPPH22014A		
S106	Switch	SPPH22014A		
BT101	Lithium Battery	BR2325-1HC		
EP101	P.C. Board	B-810I		
EP102	P.C. Board	B-824A		
EP103	F.P.C. Board	B-812		
EP104	Bead Core	DL2-OP2.6-3-1.2H		

PLL UNIT

REF. NO.	DESCRIPTION	PART NO.	
IC201	IC	MC3357P	
IC202	IC	μPB571C	
IC203	IC	μPD2834C	
Q201	Transistor	2SC2668 O	
Q202	Transistor	2SC2668 O	
Q203	Transistor	2SC2668 O	
Q204	Transistor	2SC2668 O	
Q205	FET	2SK241 Y	
Q206	Transistor	2SC3355	
Q207	Transistor	2SB561 C	
Q208	Transistor	2SC2026	
Q209	Transistor	2SC2026	
Q210	Transistor	2SC2407 A	
Q212	Transistor	2SC2458 GR	
Q213	Transistor	2SB909M R	
Q214	Transistor	2SC2458 GR	
Q215	Transistor	2SC2458 GR	
Q216	Transistor	2SA1048 GR	
Q217	Transistor	2SA1048 GR	
Q218	Transistor	2SA1048 GR	
Q219	Transistor	2SC2026	
Q220	Transistor	2SC3101	
Q221	Transistor	2SC4167-01	
D201	Diode	1SS99	
D202	Diode	1SS97	
D203	Diode	1SS216	
D204	Diode	1SS216	
D205	Diode	1SS211	
D206	Diode	1SS237	
D207	Diode	1SS237	
D208	Diode	1SS216	
D209	Diode	1SS216	
D216	Diode	1SS211	
D217	Varicap	1SV100	
D219	Diode	1SS211	
D220	Diode	1SS211	
D221	Diode	1SS211	
D222	Diode	1SS237	
D223	Diode	1SS211	
FI201	Ceramic	CFU455 E2	
FI202	Monolithic	UM-1/16M15B4	
X201	Discriminator	CDB455 C7A	
X202	Crystal	HC-18/T 16.445MHz	
X203	Crystal	HC-18/T 5.12MHz	
L201	Coil	LS-262	
L202	Coil	LS-308	
L203	Coil	LS-308	
L204	Coil	LS-308	
L205	Coil	LS-308	
L206	Coil	LA-235	
L207	Choke	LAL03NA	221K
L208	Coil	LA-234	
L209	Coil	LA-234	
L210	Coil	LA-234	
L211	Choke	LAL03NA	100K
L212	Coil	LA-233	
L213	Coil	LA-234	
L214	Coil	LA-234	
L221	Coil	LA-235	
L222	Coil	LA-232	
L224	Coil	LA-232	
L225	Coil	LA-232	
R202	Resistor	12kΩ	ELR10
R203	Resistor	680kΩ	ELR10
R204	Resistor	15kΩ	ELR10
R205	Trimmer	10kΩ	RH0521C14J08A
R206	Resistor	1MΩ	ELR10
R207	Resistor	4.7kΩ	ELR10
R208	Resistor	470Ω	ELR10
R209	Resistor	1.5kΩ	ELR10
R210	Resistor	47kΩ	ELR10
R211	Resistor	1.5kΩ	ELR10

PLL UNIT

REF. NO.	DESCRIPTION	PART NO.	
R212	Resistor	1.5kΩ	R10
R213	Resistor	47kΩ	ELR10
R214	Resistor	100Ω	ELR10
R215	Resistor	1.2kΩ	ELR10
R216	Resistor	10kΩ	ELR10
R217	Resistor	10kΩ	ELR10
R219	Resistor	1.2kΩ	ELR10
R220	Resistor	100Ω	ELR10
R221	Resistor	56Ω	R10
R222	Resistor	1.5kΩ	ELR10
R223	Resistor	100Ω	ELR10
R225	Resistor	6.8kΩ	ELR10
R226	Resistor	4.7kΩ	ELR10
R227	Resistor	5.6kΩ	ELR10
R228	Resistor	470Ω	ELR10
R229	Resistor	10kΩ	ELR10
R230	Resistor	22kΩ	ELR10
R231	Resistor	10kΩ	ELR10
R232	Resistor	1.2kΩ	ELR10
R233	Resistor	560Ω	ELR10
R234	Resistor	22Ω	ELR10
R235	Resistor	1kΩ	ELR10
R236	Resistor	100Ω	ELR10
R239	Resistor	4.7kΩ	ELR10
R240	Resistor	4.7kΩ	ELR10
R241	Resistor	150kΩ	ELR10
R242	Resistor	330Ω	ELR10
R243	Trimmer	47kΩ	RH0521CS4J0DA
R249	Resistor	10kΩ	ELR10
R252	Resistor	1.5kΩ	ELR10
R253	Resistor	1.8kΩ	R10
R254	Resistor	220kΩ	ELR10
R255	Resistor	39kΩ	ELR10
R256	Resistor	39kΩ	ELR10
R257	Resistor	100Ω	ELR10
R258	Resistor	5.6kΩ	ELR10
R260	Resistor	8.2kΩ	ELR10
R262	Resistor	47kΩ	ELR10
R263	Resistor	82kΩ	ELR10
R264	Resistor	560kΩ	ELR10
R265	Resistor	22kΩ	ELR10
R266	Resistor	15kΩ	ELR10
R267	Trimmer	22kΩ	RH0521CJ4J06A
R268	Resistor	2.2kΩ	ELR10
R269	Trimmer	2.2kΩ	RH0521CJ3J05A
R270	Resistor	1MΩ	ELR10
R271	Resistor	27Ω	ELR10
R272	Resistor	5.6kΩ	ELR10
R273	Resistor	47kΩ	ELR10
R274	Resistor	22kΩ	ELR10
R276	Resistor	1MΩ	ELR10
R277	Resistor	1kΩ	ELR10
R278	Resistor	220kΩ	ELR10
R279	Resistor	390kΩ	ELR10
R280	Resistor	4.7kΩ	ELR10
R281	Resistor	470Ω	ELR10
R282	Resistor	5.6kΩ	ELR10
R284	Resistor	47Ω	ELR10
R285	Resistor	4.7Ω	ELR10
R286	Resistor	22kΩ	ELR10
R287	Resistor	6.8kΩ	ELR10
R288	Resistor	100Ω	ELR10
R289	Resistor	100Ω	ELR10
R290	Resistor	390Ω	ELR10
R291	Resistor	100Ω	ELR10
R292	Resistor	39Ω	ELR10
R293	Resistor	220Ω	ELR10
R294	Resistor	10kΩ	ELR10
R295	Resistor	10kΩ	ELR10
C201	Electrolytic	1μF	50V RC3
C202	Ceramic	470pF	50V
C203	Ceramic	470pF	50V
C204	Ceramic	15pF	50V
C205	Barrier Layer	0.0033μF	25V
C206	Ceramic	82pF	50V
C207	Ceramic	0.001μF	50V
C208	Monolithic	0.1μF	D33Y5V1E104Z21

PLL UNIT

REF. NO.	DESCRIPTION	PART NO.		
C209	Electrolytic	0.1μF	50V	RC3
C210	Ceramic	120pF	50V	
C211	Ceramic	22pF	50V	
C212	Electrolytic	1μF	50V	RC3
C213	Ceramic	0.001μF	50V	
C214	Electrolytic	10μF	16V	RC3
C215	Barrier Layer	0.0047μF	25V	
C217	Ceramic	5pF	50V	
C218	Barrier Layer	0.0047μF	25V	
C219	Ceramic	0.001μF	50V	
C220	Barrier Layer	0.0047μF	25V	
C221	Ceramic	8pF	50V	
C222	Ceramic	0.35pF	50V	
C223	Ceramic	0.5pF	50V	
C224	Ceramic	10pF	50V	
C225	Ceramic	8pF	50V	
C226	Ceramic	0.001μF	50V	
C228	Ceramic	9pF	50V	
C229	Ceramic	8pF	50V	
C230	Ceramic	0.001μF	50V	
C231	Ceramic	0.001μF	50V	
C232	Ceramic	0.001μF	50V	
C233	Ceramic	470pF	50V	
C234	Ceramic	6pF	50V	
C235	Ceramic	0.001μF	50V	
C236	Ceramic	0.001μF	50V	
C237	Ceramic	39pF	50V	
C238	Ceramic	0.001μF	50V	
C239	Ceramic	0.001μF	50V	
C240	Ceramic	0.001μF	50V	
C241	Ceramic	10pF	50V	
C242	Ceramic	0.001μF	50V	
C245	Ceramic	10pF	50V	
C246	Ceramic	0.001μF	50V	
C247	Ceramic	0.001μF	50V	
C248	Ceramic	0.5pF	50V	
C249	Ceramic	470pF	50V	
C250	Ceramic	3pF	50V	
C251	Ceramic	15pF	50V	
C252	Ceramic	15pF	50V	
C253	Ceramic	0.5pF	50V	
C254	Ceramic	3pF	50V	
C255	Ceramic	470pF	50V	
C256	Ceramic	15pF	50V	
C257	Ceramic	0.001μF	50V	
C258	Ceramic	12pF	50V	
C259	Ceramic	15pF	50V	
C260	Ceramic	3pF	50V	
C261	Ceramic	120pF	50V	
C262	Ceramic	22pF	50V	
C263	Ceramic	470pF	50V	
C264	Ceramic	1pF	50V	
C265	Ceramic	12pF	50V	
C266	Mylar	0.0022μF	50V	
C267	Electrolytic	0.47μF	50V	RC3
C268	Electrolytic	0.47μF	50V	RC3
C273	Tantalum	0.1μF	35V	DN
C282	Tantalum	10μF	16V	DN
C283	Electrolytic	10μF	16V	RC3
C284	Ceramic	0.001μF	50V	
C285	Monolithic	0.1μF	D33Y5V1E104Z21	
C286	Electrolytic	22μF	6.3V	RC3
C287	Trimmer	10pF	ECRGA010D30	
C288	Ceramic	22pF	50V	
C289	Ceramic	0.001μF	50V	
C290	Ceramic	220pF	50V	
C292	Barrier Layer	0.01μF	25V	
C293	Ceramic	0.001μF	50V	
C295	Electrolytic	10μF	16V	RC3
C296	Ceramic	0.001μF	50V	
C297	Ceramic	0.001μF	50V	
C298	Ceramic	0.001μF	50V	
C299	Ceramic	0.001μF	50V	
C300	Ceramic	0.001μF	50V	
C301	Barrier Layer	0.0047μF	25V	
C303	Ceramic	0.001μF	50V	
C305	Tantalum	4.7μF	16V	DN
C306	Tantalum	4.7μF	16V	DN

PLL UNIT

REF. NO.	DESCRIPTION	PART NO.	
C309	Ceramic	0.001µF	50V
C310	Ceramic	100pF	50V
C312	Ceramic	22pF	50V
C313	Ceramic	0.001µF	50V
C314	Ceramic	0.001µF	50V
C315	Ceramic	33pF	50V
C316	Ceramic	10pF	50V
C317	Ceramic	0.001µF	50V
C318	Ceramic	0.001µF	50V
C319	Ceramic	18pF	50V
C320	Ceramic	47pF	50V
C321	Ceramic	0.001µF	50V
C322	Ceramic	0.001µF	50V
C323	Ceramic	47pF	50V
C324	Ceramic	0.001µF	50V
C325	Monolithic	0.1µF	D33Y5V1E104Z21
C326	Ceramic	470pF	50V
C327	Ceramic	0.001µF	50V
C328	Barrier Layer	0.1µF	16V
C329	Barrier Layer	0.1µF	16V
J201	Connector	HSJ0836-01-010	
J202	Connector	BNC-RM-106	
J203	Connector	HSJ1102-01-040	
J204	Connector	HEC0747-01-010	
J205	Connector	171255-1	
J206	Connector	171255-1	
EP201	P.C. Board	B-1326D	
EP208	F.P.C. Board	B-1050A	
EP209	Bead Core	DL2-OP2.6-3-1.2H	
EP210	Bead Core	DL2-OP2.6-3-1.2H	

LOGIC UNIT

REF. NO.	DESCRIPTION	PART NO.	
IC401	MPU	HD44795B60	
Q401	Transistor	2SC2712 Y	
Q402	Transistor	2SA1162 Y	
Q403	Transistor	2SA1162 Y	
D402	Diode	1SS187	
D404	Diode	1SS190	
D407	Diode	1SS181	
D409	Zener	RD4.7M B3	
R401	Chip	6.8kΩ	MCR10
R402	Chip	15kΩ	MCR10
R403	Chip	1MΩ	MCR10
R404	Chip	15kΩ	MCR10
R405	Chip	100kΩ	MCR10
R406	Chip	100kΩ	MCR10
R407	Chip	100kΩ	MCR10
R408	Chip	15kΩ	MCR10
R409	Chip	270kΩ	MCR10
R410	Chip	120kΩ	MCR10
R411	Chip	68kΩ	MCR10
R412	Chip	33kΩ	MCR10
R413	Chip	270kΩ	MCR10
R414	Chip	47kΩ	MCR10
R415	Chip	47kΩ	MCR10
R416	Chip	47kΩ	MCR10
R417	Chip	47kΩ	MCR10
R418	Chip	22kΩ	MCR10
R419	Chip	22kΩ	MCR10
R420	Chip	100kΩ	MCR10
R421	Chip	100kΩ	MCR10
R422	Chip	100kΩ	MCR10
R423	Chip	1MΩ	MCR10
R424	Chip	100kΩ	MCR10
C401	Monolithic	470pF	GRM40
C402	Monolithic	470pF	GRM40
C403	Monolithic	470pF	GRM40
C404	Ceramic	470pF	50V
C405	Monolithic	0.1µF	GRM40 F
C406	Monolithic	0.01µF	GRM40 F
C407	Monolithic	0.001µF	GRM40
C408	Monolithic	0.001µF	GRM40
DS401	Lamp	BQ031-22403A	
DS402	LCD	LP156A-E	
SP401	Speaker	40P-177B	
EP401	Microphone	KUC2023-01-006	
EP402	Rubber Conductor	SRCN-297B	
EP404	P.C. Board	B-811C	
EP405	F.P.C. Board	B-813A	
EP406	F.P.C. Board	B-822A	

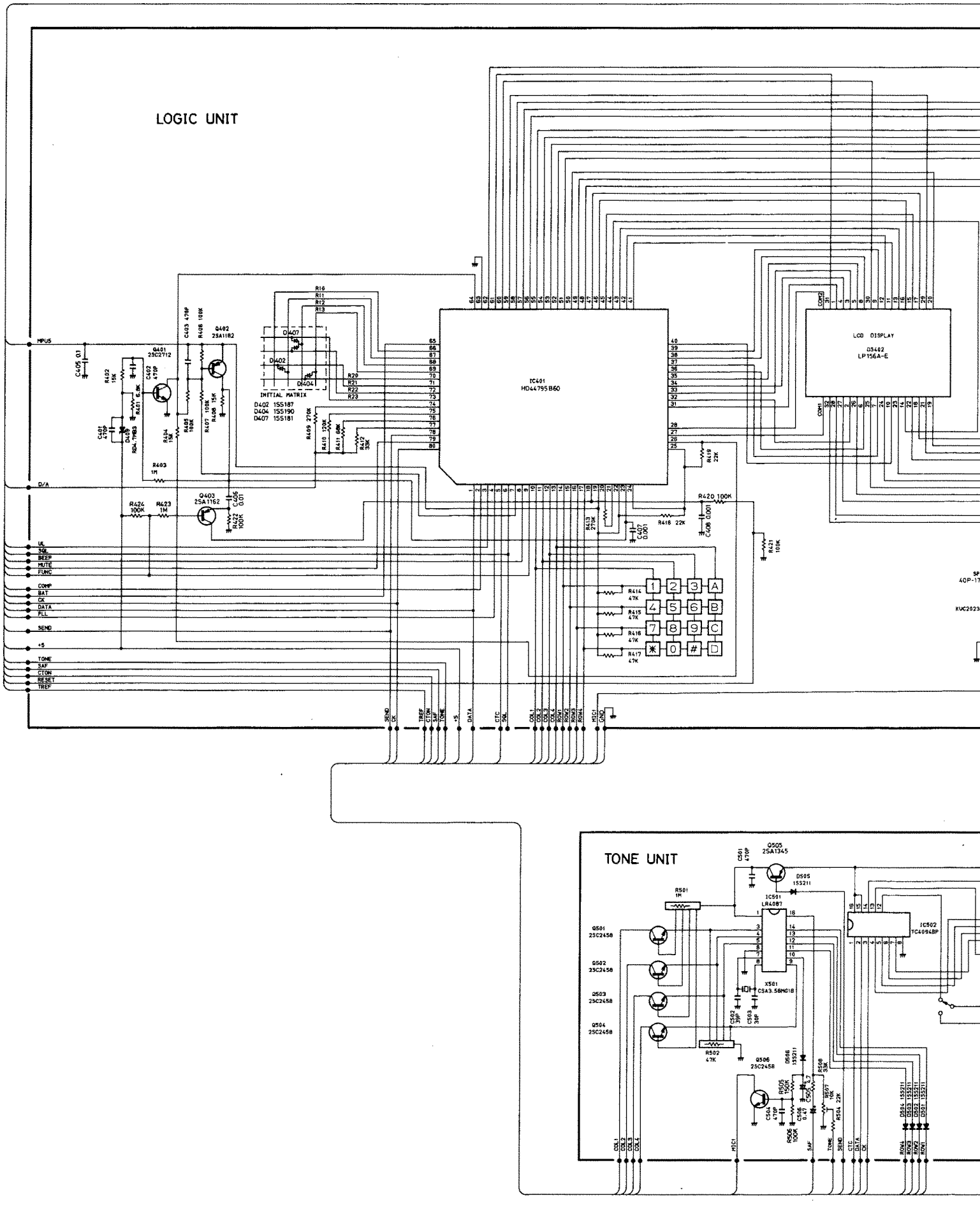
TONE UNIT

REF. NO.	DESCRIPTION	PART NO.		
IC501	IC	LR4087		
IC502	IC	TC4094BP		
IC503	IC	S-7116A		
Q501	Transistor	2SC2458 GR		
Q502	Transistor	2SC2458 GR		
Q503	Transistor	2SC2458 GR		
Q504	Transistor	2SC2458 GR		
Q505	Transistor	2SA1345		
Q506	Transistor	2SC2458 GR		
D501	Diode	1SS211		
D502	Diode	1SS211		
D503	Diode	1SS211		
D504	Diode	1SS211		
D505	Diode	1SS211		
D506	Diode	1SS211		
X501	Cera lock	CSA3.58	MG18	
X502	Crystal	HC-43/u	3579.545kHz	
R501	Array	RKL5S	105J	
R502	Array	RKL5S	473J	
R504	Resistor	22kΩ	ELR10	
R505	Resistor	150kΩ	ELR10	
R506	Resistor	100kΩ	ELR10	
R507	Trimmer	10kΩ	RH0521C14J08A	
R508	Resistor	33kΩ	ELR10	
R509	Resistor	47kΩ	ELR10	
R510	Trimmer	100kΩ	RH0521C15J05A	
R511	Resistor	39kΩ	ELR10	
C501	Ceramic	470pF	50V	
C502	Ceramic	39pF	50V	
C503	Ceramic	30pF	50V	
C504	Ceramic	470pF	50V	
C505	Electrolytic	4.7μF	16V	RC3
C506	Electrolytic	0.47μF	50V	RC3
C507	Ceramic	470pF	50V	
C508	Electrolytic	22pF	6.3V	RC3
C510	Ceramic	47pF	50V	
C511	Ceramic	39pF	50V	
C512	Electrolytic	0.47μF	50V	RC3
C513	Electrolytic	0.22μF	50V	RC3
EP501	P.C. Board	B-814B		

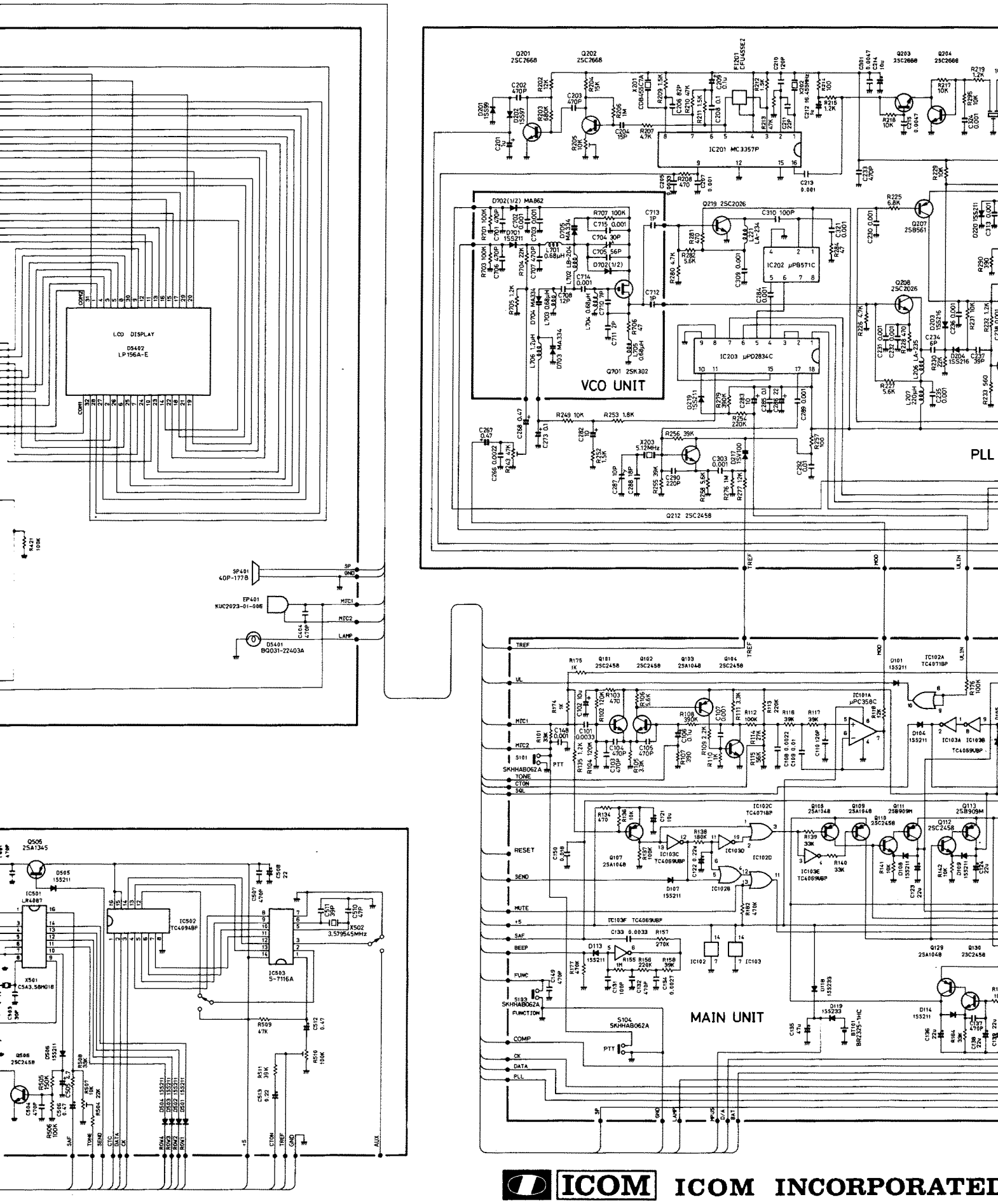
VCO UNIT

REF. NO.	DESCRIPTION	PART NO.	
Q701	FET	2SK302 Y	
D701	Diode	1SS211	
D702	Diode	MA862	
D703	Varicap	MA334	
D704	Varicap	MA334	
D705	Varicap	MA334	
L701	Choke	LQH3N	R68
L702	Coil	LB-204	
L703	Choke	LQH3N	R68
L704	Choke	LQH3N	R68
L705	Choke	LQH3N	R68
L706	Choke	LQH3N	1R2
R701	Chip	100kΩ	MCR10
R703	Chip	100kΩ	MCR10
R704	Chip	22kΩ	MCR10
R705	Resistor	1.2kΩ	R10
R706	Chip	47Ω	MCR10
R707	Chip	100kΩ	MCR10
C701	Ceramic	470pF	50V
C702	Monolithic	0.001μF	GRM40
C703	Monolithic	0.001μF	GRM40
C704	Trimmer	20pF	TZB04R200BA
C705	Monolithic	68pF	GRM40
C706	Monolithic	470pF	GRM40
C707	Monolithic	470pF	GRM40
C708	Monolithic	12pF	GRM40
C710	Monolithic	7pF	GRM40
C711	Monolithic	0.5pF	GRM40
C712	Ceramic	1pF	50V
C713	Ceramic	1pF	50V
C714	Monolithic	0.001μF	GRM40
C715	Monolithic	0.001μF	GRM40
EP701	P.C. Board	B-1321B	

IC-03AT SCHEMATIC DIAGRAM



DIAGRAM



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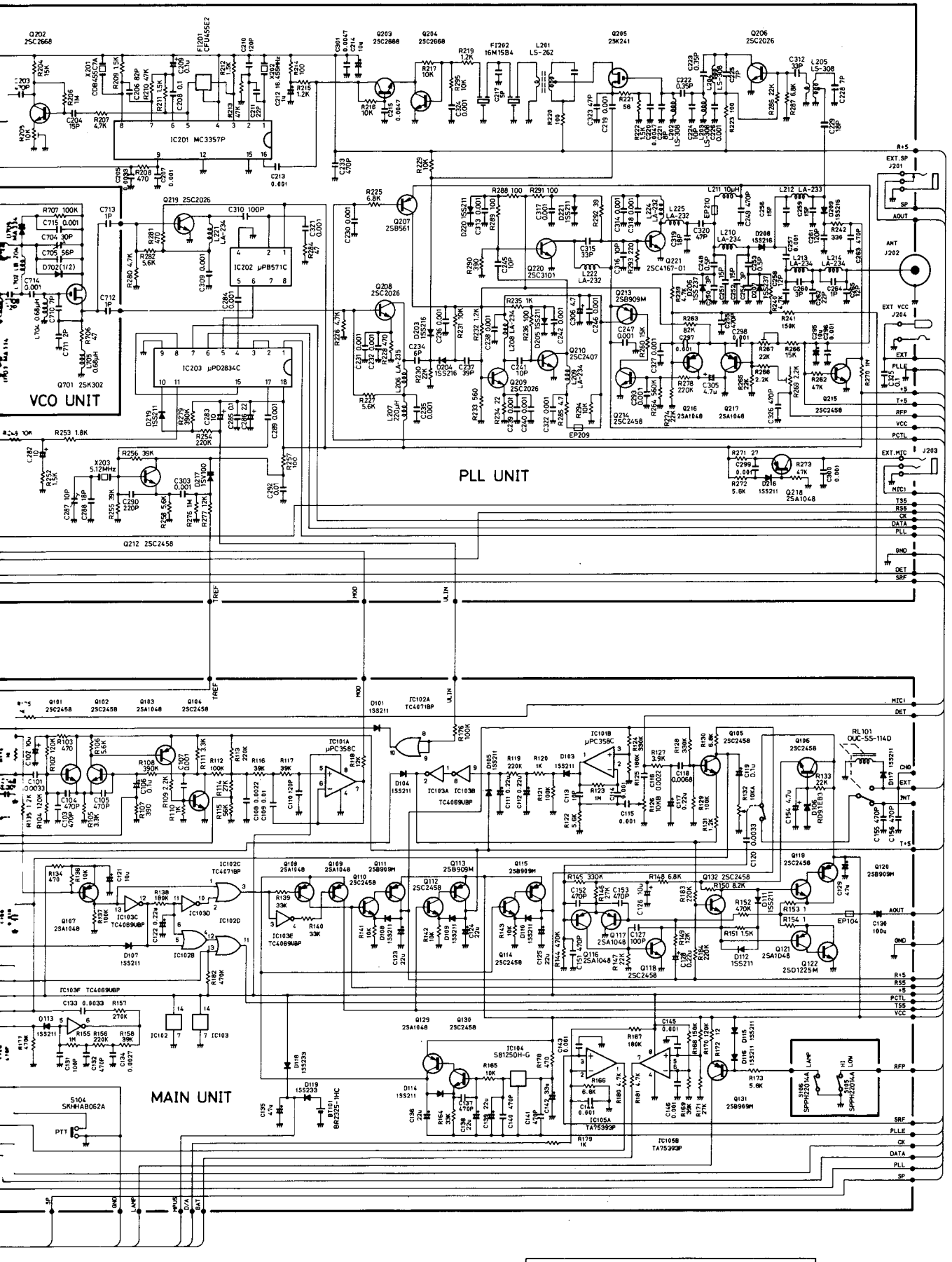
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